

Drägermedical

A Dräger and Siemens Company

Operator's Instruction Manual

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Narkomed 6400 Anesthesia System

WARNING: For a full understanding of the performance characteristics of this anesthesia machine, the user should carefully read this manual before operating.

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Introduction

This section describes the operator's responsibility for patient safety, limit of liability, and general warnings and cautions relating to the Narkomed 6400 with Divan ventilator. Abbreviations and terms used throughout the manual are also described.

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Operator's Responsibility for Patient Safety

Draeger Medical anesthesia products are designed to provide the greatest degree of patient safety that is practically and technologically feasible. The equipment design, the accompanying literature, and the labeling on the equipment take into consideration that the purchase and use of the equipment are restricted to trained professionals, and that certain inherent characteristics of the equipment are known to the trained operator. Instructions, warnings, and caution statements are limited, therefore, to the specifics of the Draeger Medical design. This publication excludes references to hazards which are obvious to a medical professional, to the consequences of product misuse, and to potentially adverse effects in patients with abnormal conditions. Product modification or misuse can be dangerous. Draeger Medical disclaims all liability for the consequences of product alterations or modifications, as well as for the consequences which might result from the combination of Draeger Medical products with products supplied by other manufacturers if such a combination is not endorsed by Draeger Medical.

The operator of the anesthesia system must recognize that the means of monitoring and discovering hazardous conditions are specific to the composition of the system and the various components of the system. It is the operator, and not the various manufacturers or suppliers of components, who has control over the final composition and arrangement of the anesthesia system used in the operating room. Therefore, the responsibility for choosing the appropriate safety monitoring devices rests with the operator and user of the equipment.

Patient safety may be achieved through a variety of means depending on the institutional procedures, the preference of the operator, and the application of the system. These means range from electronic surveillance of equipment performance and patient condition to simple, direct contact between operator and patient (direct observation of clinical signs). The responsibility for the selection of the best level of patient monitoring belongs solely to the equipment operator. To this extent, the manufacturer, Draeger Medical, disclaims responsibility for the adequacy of the monitoring package selected for use with the anesthesia system. However, Draeger Medical is available for consultation to discuss monitoring options for different applications.

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Restriction

Federal law restricts this device to sale by, or on the order of, a physician.

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Disclaimer

The content of this manual is furnished for informational use only and is subject to change without notice. Draeger Medical, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in this manual.

Recommendations

In the interest of patient safety, Draeger Medical strongly advocates the use of an oxygen analyzer, pressure monitor, and either a volume monitor or an end-tidal CO₂ monitor in the breathing circuit at all times.

Because of the sophisticated nature of Draeger Medical anesthesia equipment and its critical importance in the operating room setting, it is highly recommended that only appropriately trained and experienced professionals be permitted to service and maintain this equipment. Please contact DrägerService at (800) 543-5047 for service of this equipment.

Draeger Medical also recommends that its anesthesia equipment be serviced at three-month intervals. Periodic Manufacturer's Service Agreements are available for equipment manufactured by Draeger Medical. For further information concerning these agreements, contact DrägerService at (800) 543-5047.

Purpose of This Manual

This manual provides operating instructions for the Narkomed 6400 Anesthesia Workstation equipped with the Divan ventilator. It is intended for use by trained clinical professionals familiar with accepted medical procedures, practices, and terminology used in delivery of anesthesia and patient monitoring.

How This Manual Is Organized

All users of this equipment must read this manual completely before using the equipment.

To make this document more convenient for future reference, it has been divided into several independent sections. Each section contains either general information about the Narkomed 6400 or instructions on how to use it.

Introduction provides restriction and liability statements, discusses organization of the manual, and provides system warnings and cautions.

System Description describes the main components of the system and some theory of operation.

System Configuration describes overall customization of the monitoring system, including alarm management.

Configuration and Settings - Gas Analysis describes clinical customization of the analytical data collected by the gas analysis pod.

Configuration and Settings - Volume, Pressure, and Oxygen describes clinical customization of the analytical data collected by the volume, pressure, and oxygen (VPO) monitor.

Configuration and Settings - Ventilator describes clinically-determined adjustments that may be made to the ventilator for each mechanical breathing mode.

Checkout Procedures describes the full procedure for daily checkout of the Narkomed 6400, as well as an abbreviated preuse checkout between cases.

Operation Summary describes how to start and end a case, as well as operator response to some irregular situations.

Messages / Problem Resolution describes the system alarm structure and a summary of warning, caution, and advisory messages that may be encountered during patient monitoring.

General Care and Maintenance lists general cleaning and maintenance procedures, including some disassembly and reassembly procedures required for access.

Specifications lists the technical specifications for all system components.

Appendices include general information about system messages and components.

An extensive *index* is provided for ease in learning about and efficiently using the Narkomed 6400 features.

Conventions Used in This Manual

This manual has been set up with several conventions to help organize the information contained in it. Please read about these conventions carefully so that you understand their significance in the manual.

Typefaces

A different typeface is used throughout the manual to differentiate between narrative information and machine messages and labels.

<i>Examples:</i>	[O2 CAL]	ventilator or monitor control button label; tab label in parameter notebook
	REVERSE FLOW	monitor or ventilator message
	System Standby	system status description

Warnings and Cautions

All parts of this manual contain warning and caution statements about the Narkomed 6400.

- *Warning* statements give important information that, if ignored, could lead directly to personal injury.
- *Caution* statements give important information that, if ignored, could lead directly to equipment damage and indirectly to personal injury.

General Warnings

The following warnings apply to general operation and maintenance of the Narkomed 6400 anesthesia machine, equipped with the Divan Ventilator and Narkomed Ultrasonic Flow Sensor. Warnings specific to subsystems appear in later sections.

Warning: Any person involved with the setup, installation, operation or maintenance of the Narkomed 6400 anesthesia system must be thoroughly familiar with this instruction manual.

However, instructions in this manual in no way supersede established medical procedures for patient care.

Warning: This anesthesia system will not respond automatically to certain changes in patient condition, operator error, or failure of components. The system is designed to be operated under the constant surveillance and control of a qualified operator.

Warning: No third-party components shall be attached to the anesthesia machine, ventilator, or breathing system (except for certain approved exceptions). Contact DrägerService for further information.

Warning: Do not apply unregulated suction to the patient circuit when using this device.

Warning: The Narkomed 6400 anesthesia system must be serviced only by an authorized representative of DrägerService.

Warning: A test for leakage current must be performed by qualified biomedical engineering personnel before use if the Narkomed 6400 is interfaced with other equipment.

Warning: A preuse checkout procedure must be performed immediately before each use of the Narkomed 6400. A recommended procedure is provided in this manual.

Warning: To avoid electrical shock hazard:

- Due to the risk of electric shock, do not remove any component cover. Refer any servicing to DrägerService.
- Use only hospital-grade grounded electrical outlets and power cord.
- Make sure the external equipment is hospital-grade grounded before connecting the equipment.
- Disconnect the power supply from the electrical outlet before cleaning. Let it dry completely before reconnecting it to the electrical outlet. **Always ensure that the clamp for the power cord, at the power supply end, is tight thus preventing an accidental disconnect from the unit.**
- Do not connect additional external equipment other than equipment specified by Draeger Medical.

Warning: To ensure patient safety:

- This device must be used by, or on the order of, a physician.
- Constant attention by a qualified professional is needed whenever a patient is under anesthesia or connected to a ventilator. Some equipment malfunctions may pass unnoticed in spite of the monitor alarms.
- Always make sure that alarm limits are set and alarms are active when monitoring a patient. Do not rely exclusively on the audible alarm system for patient monitoring. Adjusting the alarm volume to a low level during patient monitoring can jeopardize the patient.
- If the accuracy of any value display is in doubt, first determine the patient's vital signs by alternate means before verifying that the monitor is working correctly.
- If the display loses patient data, it is possible that active monitoring is not being performed. Close patient observation or alternate monitoring devices should be used until monitor function is restored.

Warning: If fluids are accidentally spilled on the equipment, take the Narkomed 6400 out of service. Turn the power switch to **STANDBY** and unplug the main power cord from the AC outlet.

Warning: When moving the anesthesia machine, remove all monitors and equipment from the top shelf, and use only the machine handles. The anesthesia machine should only be moved by people who are physically capable of handling its weight. Draeger Medical recommends that two people move the anesthesia machine to aid in its maneuverability. Exercise special care so that the machine does not tip when moving up or down inclines, around corners, and across thresholds (for example, in door frames and elevators). Do not attempt to pull the machine over any hoses, cords, or other obstacles on the floor.

Warning: Only configure the Narkomed 6400 for optional accessory mounting systems using one of the permitted combinations listed in Appendix 3 of this manual. Use of any other configuration may create a tip hazard.

Caution: Although designed to minimize the effects of ambient radio-frequency interference, the Narkomed 6400 may be adversely affected by the operation of electrosurgical equipment or shortwave/microwave diathermy equipment in the vicinity.

Caution: Do not place more than 100 pounds on top of the Narkomed 6400 top shelf.

Caution: Do not place more than 30 pounds on top of the Divan ventilator.

Symbols and Abbreviations

The following symbols and abbreviations appear throughout this manual.



inspiratory inlet



expiratory outlet



bag symbol



gas return symbol



important note symbol

APL adjustable pressure limiter (pop-off) valve

BAG connection for breathing bag

cmH₂O centimeters of water pressure

CO₂ carbon dioxide

C_{pat} patient compliance

C_{syst} system compliance

DISS diameter-indexed safety system

% I.P. ratio of inspiratory pause time/inspiration time

kPa kilopascals

Manual/Spont. manual ventilation or spontaneous breathing

MAC minimum alveolar concentration

N₂O nitrous oxide

O₂ oxygen

OFPD oxygen failure protection device

ON/OFF switched on, activated/switched off, de-activated

ORC oxygen ratio controller

Pmax	maximum allowable breathing pressure
PMC	Periodic Manufacturer's Certification
Pset	pressure setpoint
PEEP	positive end-expiratory pressure
psi	pounds per square inch, pressure measurement unit
Rate	breath rate in Volume and Pressure Modes
SIMV	synchronized intermittent mandatory ventilation
SIMV Rate	breath rate in SIMV Mode
I:E	ratio of inspiration time to expiration time
VPO	Volume, Pressure, Oxygen
Vt	tidal volume

Equipment Symbols

These symbols appear on the label on the back of the Narkomed 6400:



CAUTION:

Refer to accompanying documents before operating equipment.

ATTENTION:

Consulter les documents ci-joints avant de faire fonctionner l'appareil.



CAUTION:

Risk of electrical shock. Do not remove cover. Refer servicing to qualified service personnel.

ATTENTION:

Danger d'électrocution, ne pas enlever le couvercle. Aucune réparation ne doit être entreprise par une personne nonqualifiée.

This symbol can be seen under the ventilator when the table top is raised and the compact breathing system removed:



CAUTION:

Surface may be hot. Do not touch.

ATTENTION:

Peut-être que c'est très chaud. Ne touchez pas la surface.

Glossary

Alarm Standby	operator has touched bell icon for an operator-controlled alarm in parameter box on main screen, <u>or</u> operator has selected [STBY] at [Alarm Control] setting in volume, agent, or carbon dioxide parameter notebook. In both cases, the bell icon is grayed out.
Interlock	<p>a device that automatically prevents or requires a specific following action.</p> <p><i>Example 1:</i> vaporizer interlock prevents the use of more than one anesthetic by closing one vaporizer source when the other is opened.</p> <p><i>Example 2:</i> oxygen failure protection device (OFPD) interlock decreases pressure of other gases when oxygen pressure is restricted, in proportion to the decreased oxygen pressure.</p>
Key	general term for control button; may be ventilator control button, monitor selection button, or monitor command button, depending upon context. See associated text.
Mean	<p><u>Breathing Pressure</u>: an average of all of the instantaneous pressure values recorded during each breath</p> <p><u>Agent/Nitrous Oxide/Carbon Dioxide Concentration</u>: derivative of "running averages" of real-time data over a period of 5 seconds. Although continuously calculated, mean data is displayed on the monitor only when carbon dioxide respiration cannot be accurately detected.</p>
Monitor Control Buttons	<p><u>Command</u>: initiate an action by pressing them once. <i>Example:</i> [Threshold Pressure Autose]</p> <p><u>Selection</u>: positioned next to a text box or window, that indicates the current setting. The setting is selected by touching the button repeatedly until the preferred value appears next to it. <i>Example:</i> [Alarm Control] or [Set GAP Delay Period]</p>
Monitor Standby	operator has touched [Monitor Standby] control button on monitor touch screen. The monitor standby screen replaces the main screen on the monitor.

System Standby operator has selected **STANDBY** position for Narkomed 6400 system power switch.

Ventilator Standby operator has pressed control button **[Standby]** on Divan ventilator control panel; **VENT STANDBY** appears as an advisory on the monitor.

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System Description

This section describes and illustrates the Narkomed 6400 components and provides relevant theory of operation.

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Narkomed 6400 Overview

The Narkomed 6400 anesthesia workstation consolidates a number of functions formerly executed by several pieces of equipment. As a stand-alone anesthesia workstation, it directs many tasks automatically, including:

- anesthetic gas and agent delivery
- automatic ventilation
- ventilation monitoring, including pressure and volume monitoring

- inspired and expired gas monitoring, including concentrations of anesthetic agent, nitrous oxide (N₂O), carbon dioxide (CO₂) and oxygen (O₂)
- anesthetic agent identification in both inspired and expired gases.

Although the Narkomed 6400 is completely integrated to perform these anesthesia delivery and monitoring tasks, it is also capable of being upgraded. Desired enhancements may include additional monitoring equipment. Likewise, integrated data management modules may be attached to communicate with the hospital's patient records system.

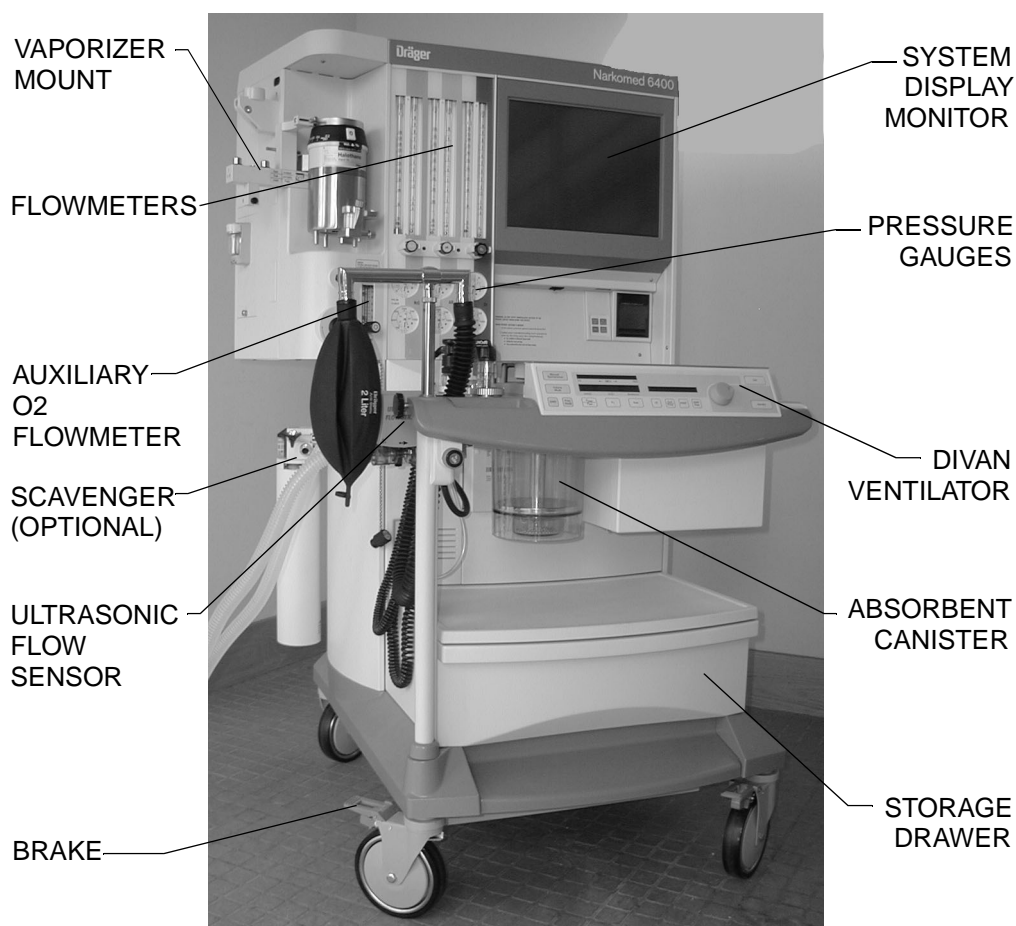


Figure 2-1. Narkomed 6400 Anesthesia Workstation

Narkomed 6400 operating system components include:

- gas delivery system
- vaporizer mount and interlock system
- Divan ventilator
- Narkomed ultrasonic flow sensor

- power supply system
- monitoring system
- measurement subsystems
- piping
- open reservoir scavenger or interface for passive scavenger system (CUSTOMER OPTION)
- strip chart recorder (SCR) (CUSTOMER OPTION)
- patient suction system (CUSTOMER OPTION)
- auxiliary video output (CUSTOMER OPTION)
- surgeon display controller (CUSTOMER OPTION)
- sheet printer interface (CUSTOMER OPTION)

A brief description of the capabilities of each system component follows. Please see Sections 7 and 8 of this manual for details on Narkomed 6400 operation.

The Narkomed 6400 incorporates three interfaces: a gas delivery interface in a cockpit-style design, a configurable monitoring interface accessed through a touch screen, and a ventilator interface for adjustment/display of programmed parameters.

Gas Delivery System

The Narkomed 6400 can simultaneously deliver up to three gases and one anesthetic agent. Three pipeline gas inlets connect to central gas delivery systems, and three yokes connect to cylinder gas supplies.

Each gas supply has separate controls and flowmeter indicators. Individual pressure gauges provide pressure readings. All connectors, valves, gauges, and flowmeters are labeled and color-coded for the appropriate gas as shown in the following table.

Gas System Color Coding			
Gas	Marking	USA	ISO
Air	AIR	Yellow	Black/White Checkered
Nitrous Oxide	N ₂ O	Blue	Blue
Oxygen	O ₂	Green	White

OP00669

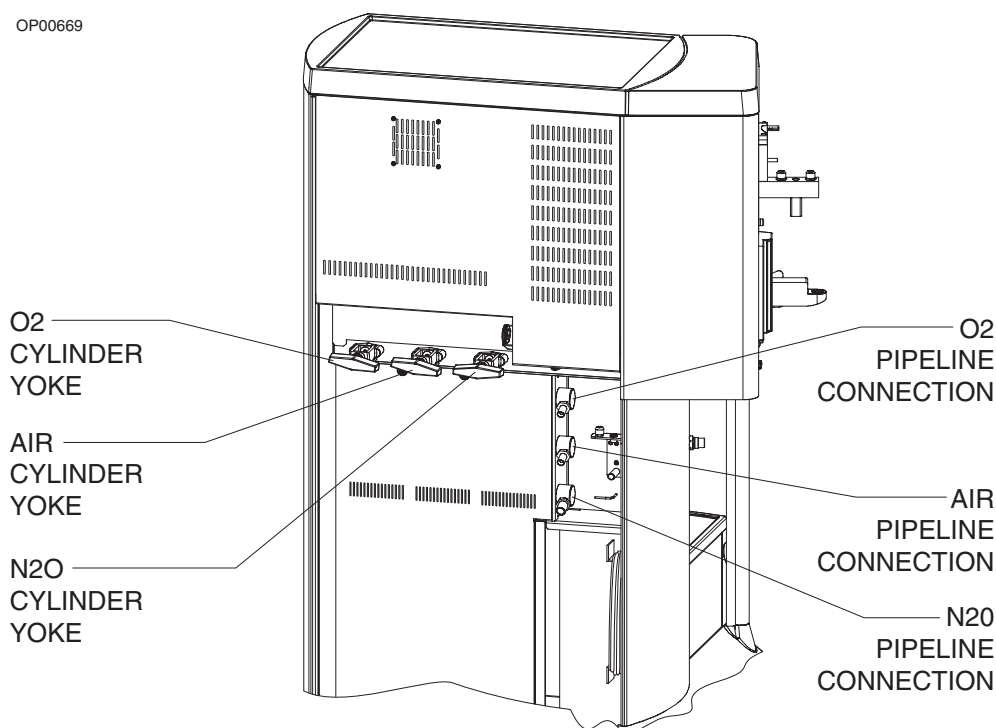


Figure 2-2. Gas Delivery System Connections

Pipeline Gas Supply to the Narkomed 6400

The Narkomed 6400 features a controlled gas hookup that reduces the risk of delivering the wrong gas to a patient. Pipeline gas inlets are indexed for air, nitrous oxide, and oxygen fittings to be keyed to corresponding outlets of hospital pipeline gases. The risk of incorrect connection of gas hoses is thereby minimized. Pipeline gases should be supplied at 50 to 55 psi.

The system design also protects the patient, clinician, and its own systems from contamination. Each pipeline gas inlet has a check valve that prevents backflow leakage into the atmosphere when supply hoses are not connected. Check valves also prevent pipeline flow into the internal gas lines of the Narkomed 6400 when reserve cylinders are used. In addition, filters in each pipeline connection prevent foreign material from entering the Narkomed 6400.

Cylinder Gas Supply

When centrally-supplied gases are not used, the system runs on cylinder-supplied gases. The Narkomed 6400 has a standard cylinder yoke configuration of one yoke for each gas: oxygen, air, and nitrous oxide. (Field-upgraded machines may have a different yoke configuration).

The controlled gas hookup for cylinders reduces the risk of delivering the wrong gas to a patient. The cylinder yokes are labeled, color-coded, and keyed for cylinders containing particular gases. A pin-indexed safety system prevents incorrect cylinders from being connected to the yoke.

Narkomed 6400 design protects the patient, clinician, and its own systems from contamination while operating on cylinder gas. A check valve in each yoke prevents leakage of ambient air into the patient circuit if a cylinder is not mounted on the yoke. The check valve also prevents movement of gas from one cylinder to another when two cylinders of the same gas are attached. In addition, filters in each yoke prevent foreign material from entering the internal gas system of the Narkomed 6400. Further protection from contamination is provided by a yoke plug, attached to the yoke.

Flowmeter Bank

The Narkomed 6400 provides highly visible, easily scanned controls and indicators for all gases flowing through its systems. The flowmeter bank houses flowmeters, flow control valves, and pressure gauges for each gas. There are separate pressure gauges for each gas source — one for each pipeline gas supply and one for each cylinder gas supply.

Flowmeters

The flowmeters are tapered tubes scaled in milliliters per minute (mL/min) and liters per minute (L/min). Flowmeter scales are backlighted for ease of observation. A float indicator shows the flow rate of each gas in the fresh gas mixture as delivered to the Narkomed 6400. The flowmeters are labeled and color-coded for gas identification.

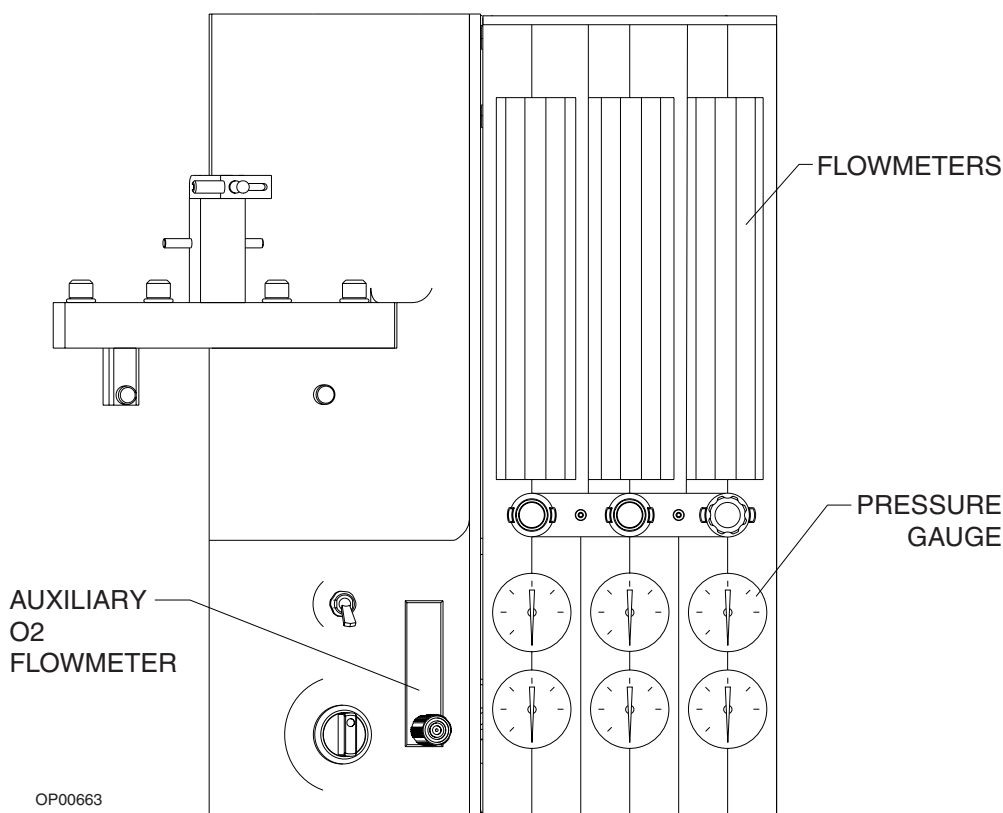
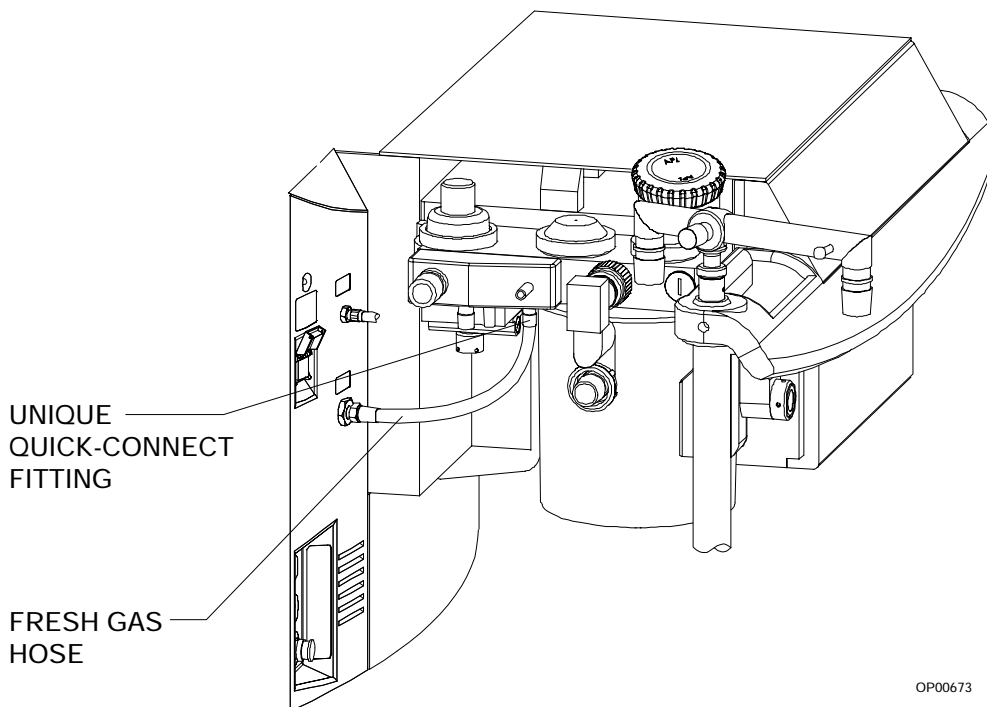


Figure 2-3. Flowmeter Bank

Flow Control Valves	<p>Adjustment knobs for the control valves that regulate gas flow are located below their respective flowmeter tubes. They are labeled and color-coded for gas lines containing particular gases. The oxygen flow control valve is also touch-coded with a deeply fluted knob (bezel). Turning the valve adjustment knob counterclockwise increases gas flow. Turning the knob clockwise decreases flow. A knob guard prevents accidental adjustments to the gas flow. A zero-stop prevents damage to the flow control valve seat.</p>
Pipeline Pressure Gauges	<p>Pipeline pressure gauges are located below their corresponding flow control valves. The flowmeter panel is labeled and color-coded for pipelines containing particular gases. Concentric scales in psi and kPa indicate the pipeline supply pressure.</p>
Cylinder Pressure Gauges	<p>Below their corresponding pipeline pressure gauges, the cylinder pressure gauges show remaining cylinder pressure. The flowmeter panel is labeled and color-coded for cylinder lines containing particular gases. Concentric scales in psi and kPa indicate the cylinder gas pressure when the cylinder valve is open.</p> <p>For nonliquified gases like oxygen and air, the pressure indicates the proportion of gas in the cylinder. For a liquefied gas like nitrous oxide, the gauge indicates the vapor pressure of the liquefied gas in the cylinder. This pressure remains constant until all of the liquid in the cylinder is vaporized. When the liquid is vaporized, the cylinder pressure decreases proportionally as gas is removed from the cylinder.</p>
Electronic Fresh Gas Measurement	<p>In addition to the flowmeters, the Narkomed 6400 has an electronic flow measurement system which can display current flow readings for air, oxygen, and nitrous oxide on the Narkomed 6400 monitor screen. It also has the capability to export the data via Vitalink to an information management system. See “Fresh Gas Information” on page 3-45 of this manual for more information.</p>

Fresh Gas Outlet

The fresh gas outlet delivers the fresh gas mixture consisting of the gases selected and the vapors of a liquid anesthetic agent to the patient breathing system. It is located below the ventilator on the left front of the machine. The quick connect fitting used is unique to the Narkomed 6400 and cannot be replaced by a hose from any other make or model of anesthesia machine.



OP00673

Figure 2-4. Fresh Gas Outlet with Quick-Connect Fitting

Oxygen Gas Supply Special Features

Auxiliary Oxygen Flowmeter

The auxiliary oxygen flowmeter (see Figure 2-3) delivers a metered flow of pure oxygen, used, for example, in the delivery of oxygen through a nasal cannula. Auxiliary oxygen can also be used when the system power switch is in the **STANDBY** position.

Oxygen Flush

A manually operated, self-closing, oxygen flush valve is located on the front left corner of the Narkomed 6400. A bezel is mounted around the pushbutton to prevent accidental engagement. When actuated, the valve delivers an unmetered oxygen flow of about 55 L/min directly to the fresh gas common outlet. The power switch does not have to be on to use the oxygen flush; it remains operative in **STANDBY** position.

OP00674

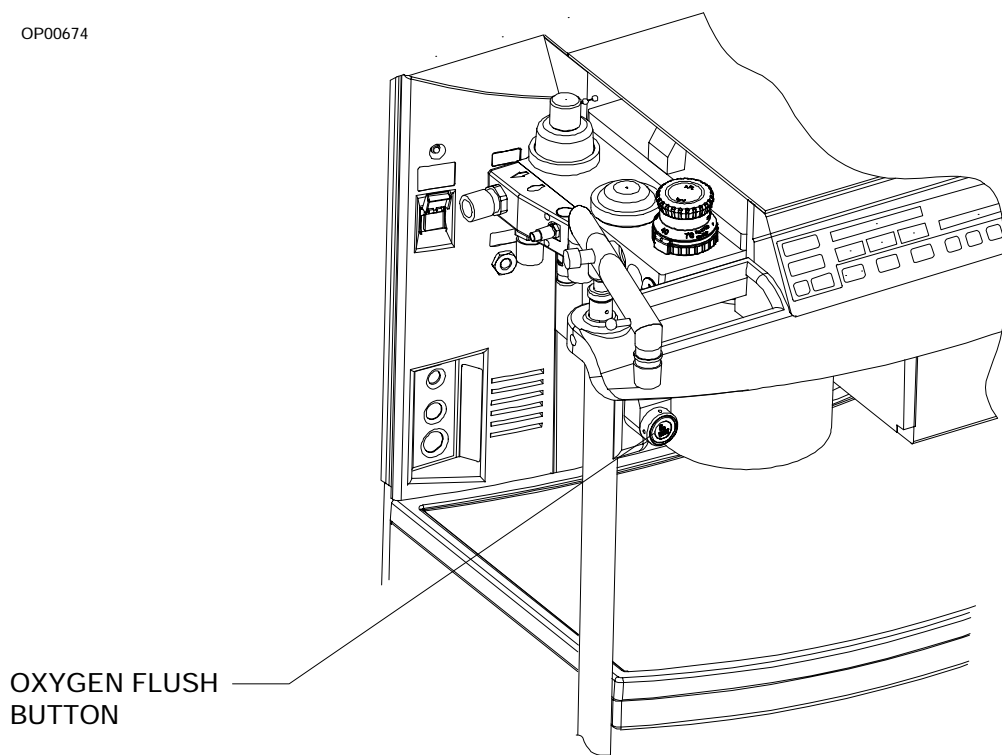


Figure 2-5. Oxygen Flush Button

Oxygen Supply Pressure Failure Protection Device

The oxygen failure protection device (OFPD) is a pneumatically operated valve that protects the patient in the event of partial or complete loss of oxygen pressure. Each gas circuit in the anesthesia machine, except the oxygen circuit, is controlled by one of these valves. These valves, in turn, are controlled by the gas pressure in the oxygen supply line. When oxygen pressure is adequate, the valves remain open for an unrestricted gas flow. Loss of oxygen pressure causes the valves to close to a degree that is proportional to the loss. The result is a restriction or shut down of the flow of all gases except oxygen.

Oxygen Low Pressure Alarm

Gas flow reductions are indicated on the flowmeter. When the oxygen supply from the pipeline or reserve cylinders drops below about 37 psi, a **O2 SUPPLY LOW** alarm is activated and, depending on the machine's configuration, a 7-second whistle may also sound. However, if only one source of oxygen supply pressure (either reserve cylinders or pipeline) fails and the other source maintains proper supply pressure, the OFPD and oxygen supply low alarm are not activated.

Minimum Oxygen Flow

The Narkomed 6400 has an oxygen dispensing system with a calibrated bypass flow of 150 \pm 50 mL/min at 50 psi pipeline pressure. This volume of oxygen is delivered even if the oxygen flow control valve should become fully closed.

Note: Minimum oxygen flow is disabled in the optional Air-Only Mode. For more information, see the *Operator's Manual for Air-Only Mode for the Narkomed 6400 Anesthesia System*.

Oxygen Ratio Controller

The ratio of oxygen to nitrous oxide is controlled by another interlock system. The oxygen ratio controller (ORC) is designed to maintain a minimum fresh gas oxygen concentration of 25 \pm 4%. It provides independent control of the oxygen and nitrous oxide flows pneumatically.

The ORC works by proportionally limiting the nitrous oxide flow whenever the selected oxygen and nitrous oxide flow control valve settings would otherwise result in a hypoxic fresh gas mixture. For example, if the clinician opens the nitrous oxide flow control valve wide open without making a corresponding increase in the oxygen flow control valve setting, the nitrous oxide flow will not increase. Similarly, if the clinician decreases the oxygen flow without also decreasing the nitrous oxide flow, the nitrous oxide flow automatically drops in proportion to the oxygen flow.

Vaporizer Mounts and Interlock Systems

The Narkomed 6400 provides mounts and an interlock system for either two vaporizers (standard) or three vaporizers (customer option). With either configuration, a mounting rack for a spare vaporizer is provided on the back of the machine as shown in Figure 2-7.

Two Vaporizer Mount and Interlock System

The two vaporizers are mounted on the left front of the machine and both are connected to the fresh gas flow. The interlock system allows the clinician to select which vaporizer can be turned on, which prevents the two vaporizers from being used simultaneously. To enable the left vaporizer, the selector lever is moved to the right to lock out the right vaporizer. To enable the right vaporizer, the selector lever is moved to the left to lock out the left vaporizer.

VAPORIZER INTERLOCK

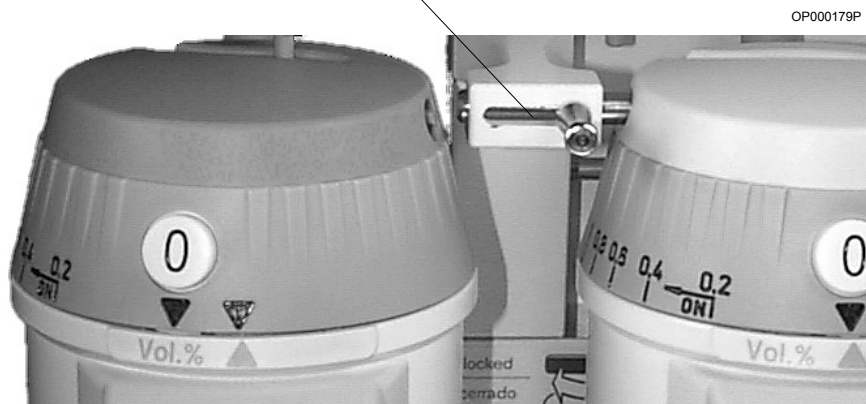
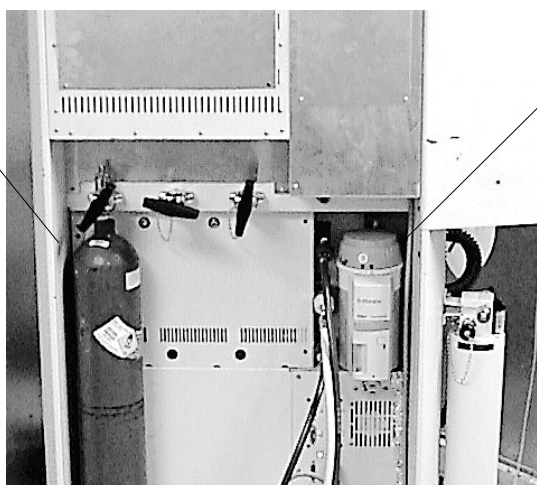


Figure 2-6. Two Vaporizer Interlock System

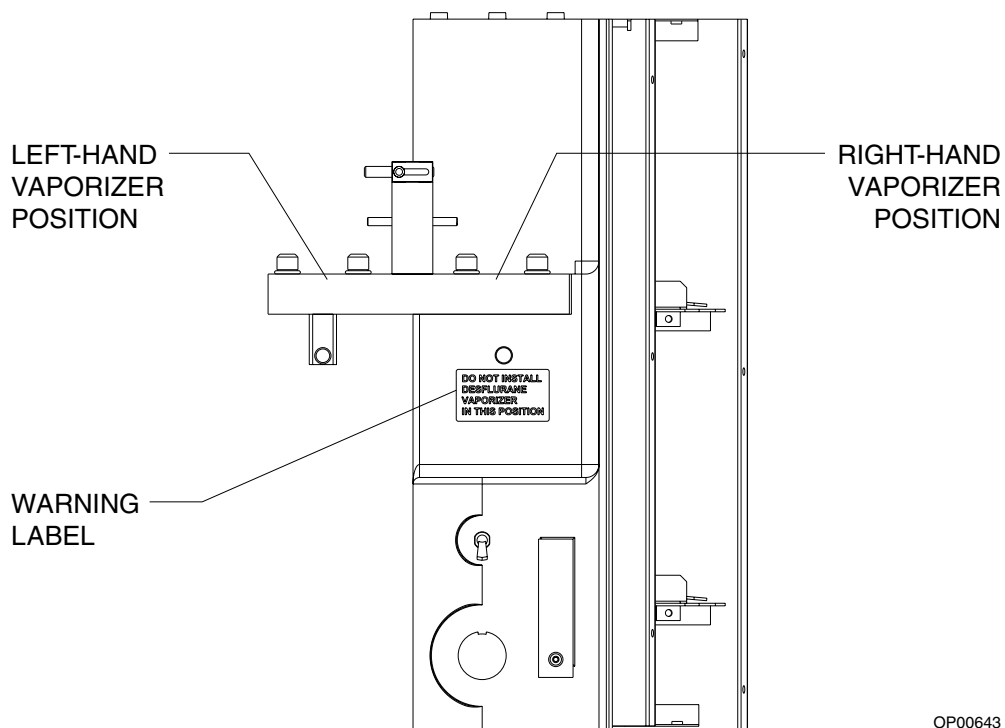
SERIAL
NUMBER
LABEL



MOUNTING
RACK FOR
SPARE
VAPORIZER

Figure 2-7. Narkomed 6400 Rear View

Warning: On machines equipped with the two vaporizer mount and interlock system, the D-tec desflurane vaporizer must be installed in the left-hand position. Installing the D-tec desflurane vaporizer in the right-hand position can lead to fresh gas and vapor leaks.



OP00643

Figure 2-8. Desflurane Warning Label (Two Vaporizer Mount and Interlock System)

Three Vaporizer Mount and Interlock System (Customer Option)

With the three vaporizer option, two of the vaporizers are mounted on the left front of the machine and the third vaporizer is mounted on the left side of the machine, above the other two vaporizers. All three vaporizers are connected to the fresh gas flow. The interlock system allows the clinician to select which vaporizer can be turned on and prevents more than one vaporizer from being used at the same time. To enable the third (top) vaporizer, move the selector lever completely up; this locks out the two bottom vaporizers.

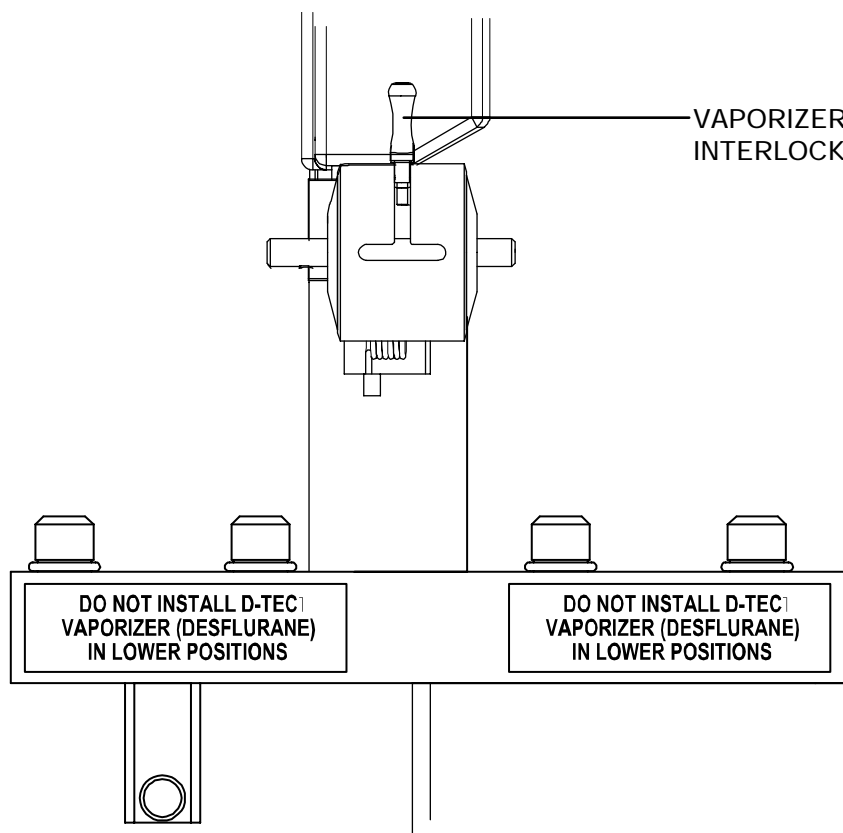
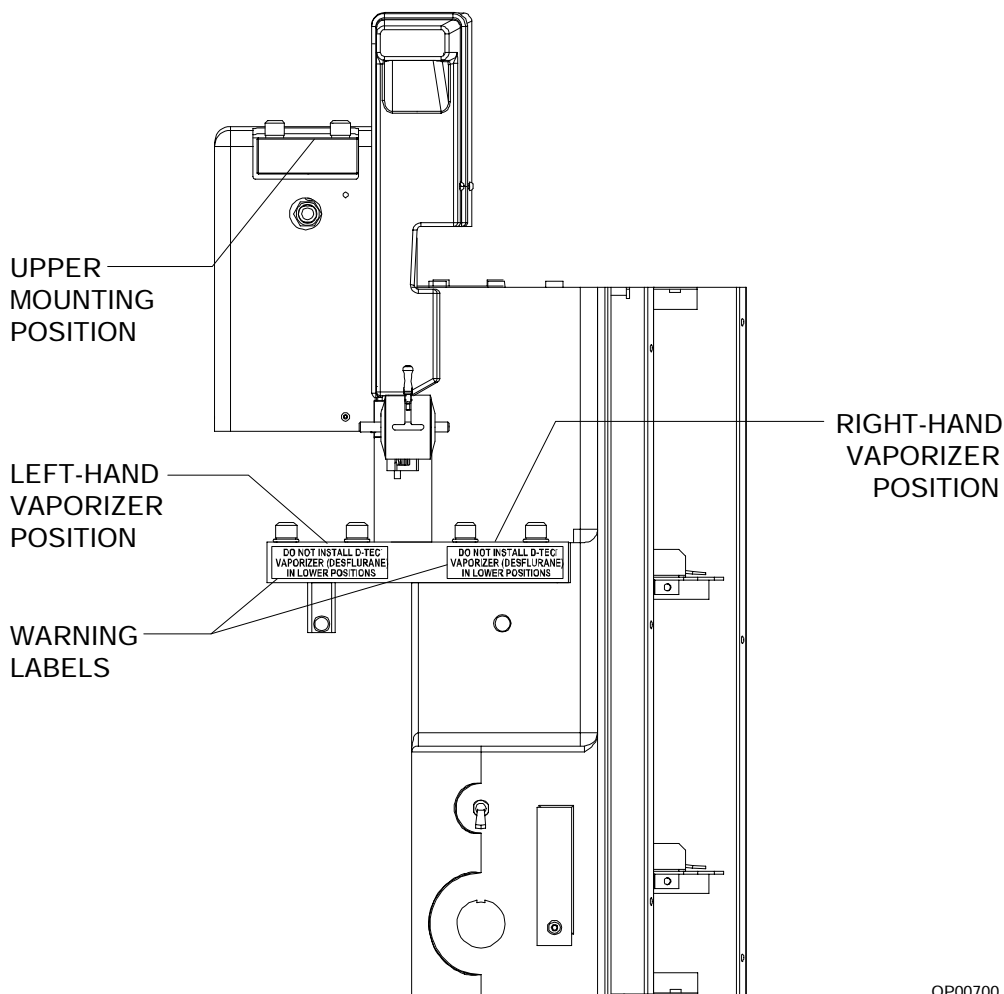


Figure 2-9. Three Vaporizer Interlock System

Warning: On machines equipped with the three vaporizer mount and interlock system, the D-tec desflurane vaporizer must be installed in the upper mounting position. Do not install the D-tec desflurane vaporizer in the lower mounting positions.



OP00700

Figure 2-10. Desflurane Labels (Three Vaporizer Mount and Interlock System)

Ventilator

Overview

The Divan ventilator is an advanced electronic anesthesia ventilator. It has an integrated compact breathing system and absorber. The operator control panel is easily accessible.

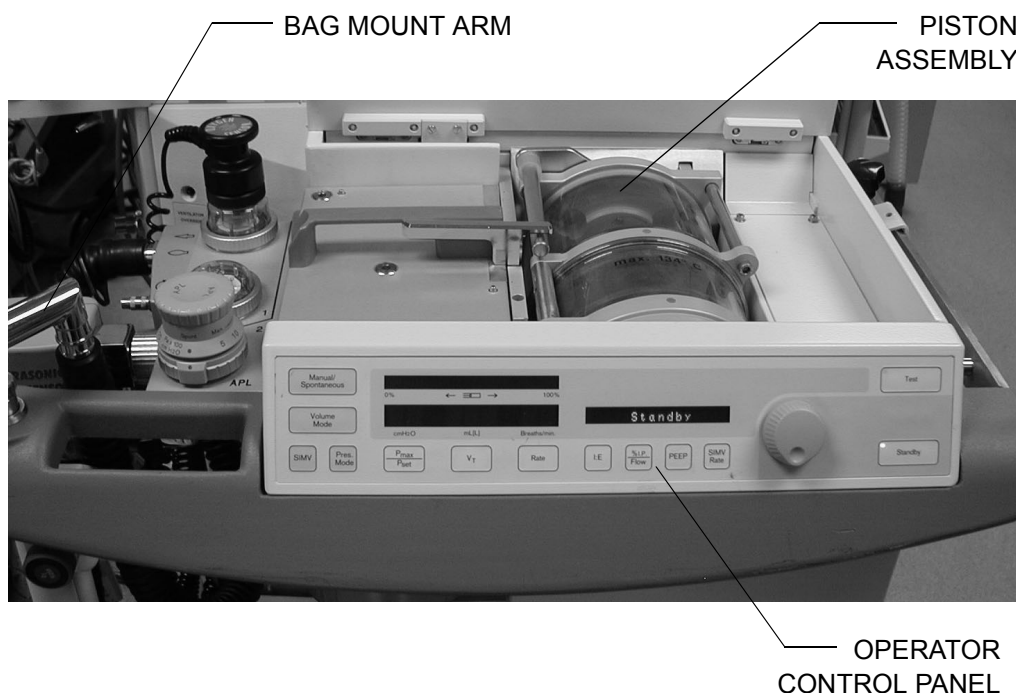


Figure 2-11. Major Components of Ventilator

Using a circle system, the ventilator supports mechanical and manual ventilation as well as spontaneous breathing. Ventilator operation may be a semi-closed to virtually closed system with low flow and minimal flow techniques.

The clinician may select Manual/Spontaneous Mode on the ventilator to support spontaneous breathing by the patient or manual ventilation by the clinician.

Under other conditions the clinician may select the specific mechanical ventilation parameters for the case. The ventilator supports three mechanical modes of ventilation:

- Volume Mode (time cycled and volume-controlled)
- Pressure Mode (time-cycled and pressure-controlled)
- Synchronized Intermittent Mandatory Ventilation (SIMV) Mode (synchronized, time-cycled, and volume-controlled).

The ventilator can control breathing patterns based on the following electronic settings:

- airway pressure
- tidal volume
- rate
- I:E ratio
- inspiratory pause
- PEEP.

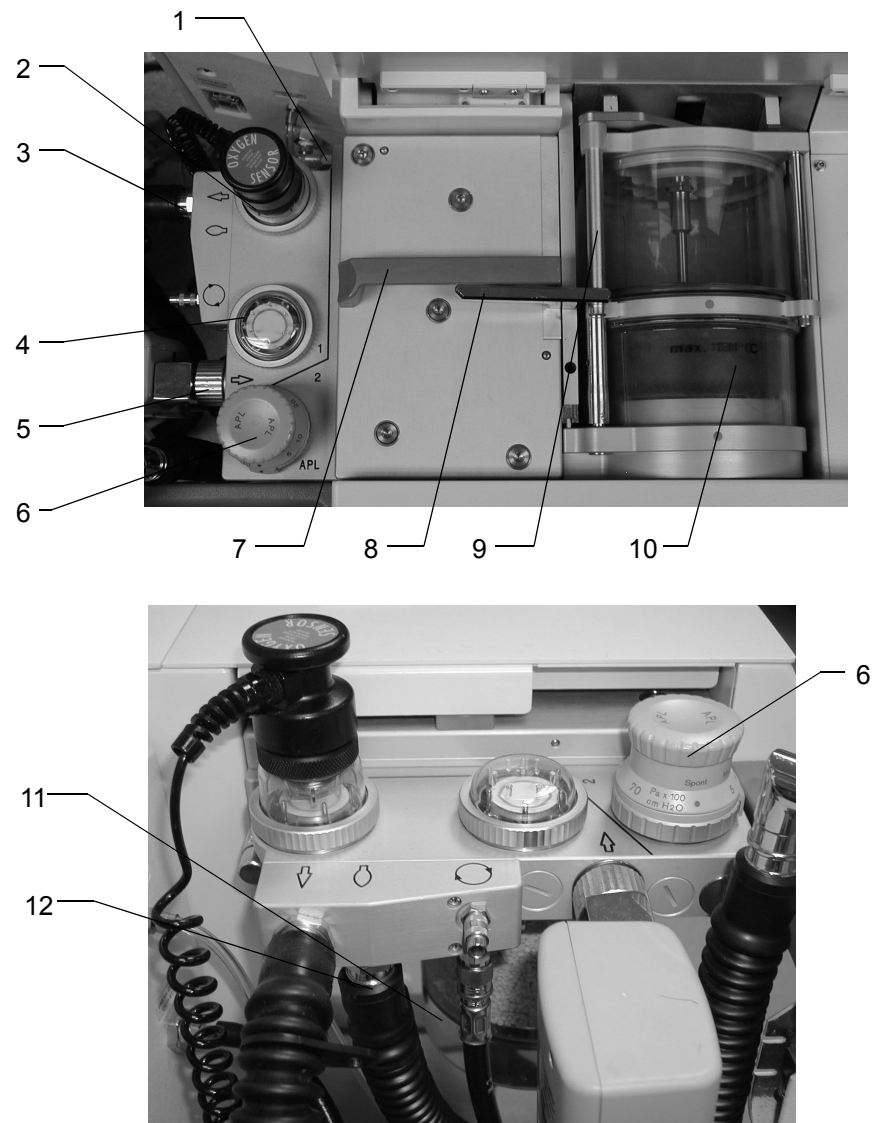
The ventilator makes automatic adjustments to ensure that preset tidal volumes are delivered to the patient, regardless of the following conditions:

- patient compliance changes
- fresh gas flow changes
- compliance losses in the breathing system, absorber, and breathing hoses.

The ventilator is designed with special features that enhance performance while minimizing the cost of inhalation anesthesia delivery.

The ventilator is intended for use as an integrated part of the Narkomed 6400. It is suitable for adults, children, and neonates. Integration of the SIMV Mode facilitates weaning of the patient from mechanical ventilation. See “SIMV Mode” on page 6-10 for discussion.

If the ventilator detects an internal fault which might affect patient safety during mechanical ventilation, it initiates a safe state in which ventilation can be continued, as in Manual/Spontaneous Mode. See “Ventilator Safe State” on page 8-25 for details. A ventilator override switch is provided for use in the unlikely event of an equipment fault which does not allow the clinician to ventilate in normal Manual/Spontaneous Mode or safe state. See “Ventilator Override” on page 8-26 for details.



Legend

- | | |
|--|--|
| 1 quick-release connection for airway pressure measurement | 7 handle of breathing system |
| 2 inspiratory valve with mount for O ₂ sensor | 8 locking lever for breathing system and piston assembly |
| 3 inspiration port | 9 release lever and handle of piston assembly |
| 4 expiratory valve | 10 piston assembly |
| 5 expiration port with mount for flow sensor | 11 absorber |
| 6 adjustable pressure limiter (APL) valve | 12 breathing bag hose connection |

Figure 2-12. Ventilator Component Details

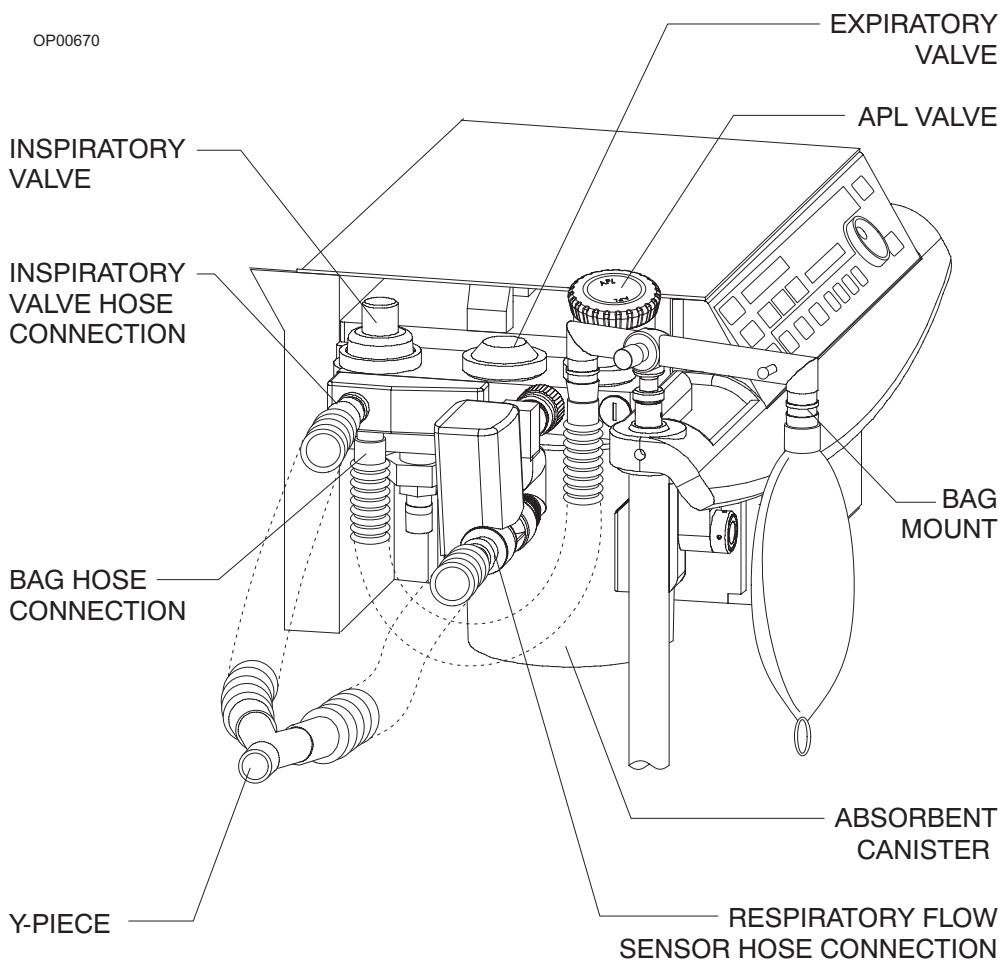


Figure 2-13. Compact Breathing System

The flow of patient gas is directed by the compact breathing system, which is fully described on page 21 of this section. The system includes:

- inspiratory and expiratory valves with patient hose connectors
- pneumatic connectors
- absorber
- APL valve (pop-off valve)
- breathing bag with re-usable and sterilizable hose.

Gas control is provided by a mechanically driven piston assembly. Details may be found on page 27 of this section.

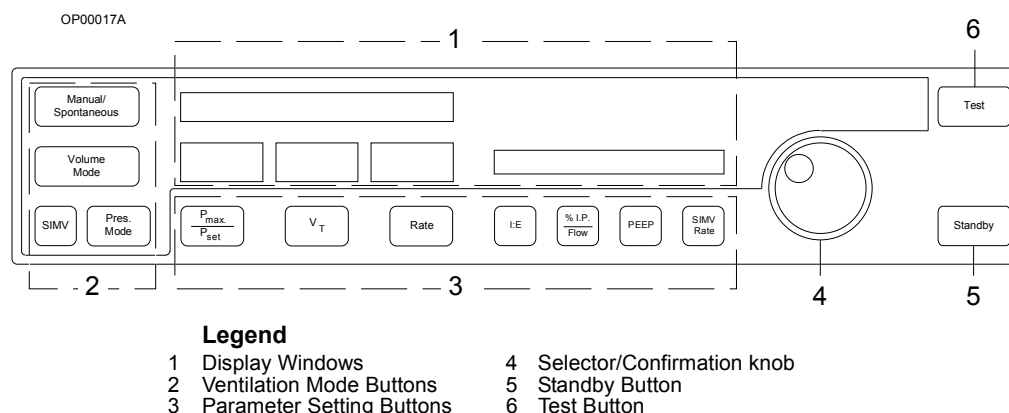


Figure 2-14. Control Panel Functional Groups

The operator control panel provides:

- a bar graph display
- a numeric display
- an alphanumeric display
- a selector/confirmation knob
- 13 functional buttons.

See “Ventilator Control Panel” on page 28 of this section for a full description of this operator interface.

Respitone (Customer Option)

Respitone is a ventilation sound composed of two distinct tones. One tone annunciates when the pressure waveform crosses the apnea threshold (corresponding to inhalation), and another tone annunciates on the rising edge of a valid CO₂ breath (corresponding to exhalation). The specific Respitone sound is chosen in the Respitone page of the Ventilator Information Notebook (see page 3-30).

Power-Up Diagnostic Tests

Power is supplied to the ventilator when the system power switch on the Narkomed 6400 is turned on. A self-diagnostic test is performed during power-up to check the ventilator and breathing system status, including leakage and system compliance. The self-diagnostic test results are displayed on the operator control panel display. The clinician can bypass the self-test in emergency situations.

A periodic leak check is automatically performed during ventilation. A system leak and compliance test can be manually performed while in **Ventilator Standby** status.

Mechanical Ventilation Modes

Mechanical ventilation is available in three modes:

Mode	Function
Volume Mode	time-cycled ventilation which controls the tidal volume delivery during inspiration
Pressure Mode	time-cycled ventilation whereby the system controls the pressure maintained during inspiration
SIMV Mode	synchronizes volume-controlled mechanical breaths with the patient's own breathing efforts, while ensuring at least a minimum breath rate

During mechanical ventilation the adjustable pressure limiter (APL) valve is isolated from the breathing system.

The ventilator has a Manual/Spontaneous Mode which bypasses mechanical ventilation to deliver gas volume via a breathing bag or through the patient's spontaneous breaths.

The ventilator also has a **Ventilator Standby** mode to minimize drive gas use and permit inspection or repairs when a patient is not being ventilated.

Warning: Assisted ventilation is not possible with the Ventilator in Ventilator Standby mode.

Tidal Volume Compensation

Due to the compliance of the breathing system, some gas displaced by the piston will not be delivered to the patient. It remains in the hoses, absorber, and breathing system of the ventilator. Depending on the ratio of lung compliance and circuit compliance, this can result in a large deviation between preset tidal volume and tidal volume delivered to the lung.

The tidal volume compensation feature measures the system compliance and enables the preset tidal volume to be delivered to the patient's lungs. The ventilator makes automatic adjustments to ensure that preset tidal volumes are delivered to the patient despite any of the following conditions:

- patient compliance changes
- fresh gas flow changes
- compression losses in the breathing system, absorber, and breathing hoses.

Fresh Gas Decoupling

During inspiration, breathing gas flows from the piston assembly to the patient. Fresh gas is isolated from the patient circuit and accumulates in the breathing bag. During expiration, the fresh gas flow and breathing bag are connected to the patient circuit and mix with breathing gas as the piston retracts and excess gas is discharged to the scavenger.

In traditional ventilators, which are not fresh gas decoupled, the delivered tidal volume is the sum of the volume delivered from the ventilator and the fresh gas volume. Fresh gas decoupling, a design feature of the Narkomed 6400, allows tidal volumes to be maintained by the ventilator, despite changes in fresh gas flow.

Low-Flow Technique

Integration of ventilator components results in efficient use of anesthetic gas and offers the choice to reduce fresh gas flow. The low-flow technique has several advantages:

- lower anesthetic gas and agent consumption
- more effective humidification and heating of inspiratory gas
- lower environmental burden.

The Divan ventilator optimizes low-flow performance by minimizing problems with excess moisture in the system. The breathing system and piston assembly were designed to minimize compressible volume. A heater has been incorporated into the design to minimize the condensation of moisture when using the low-flow technique.

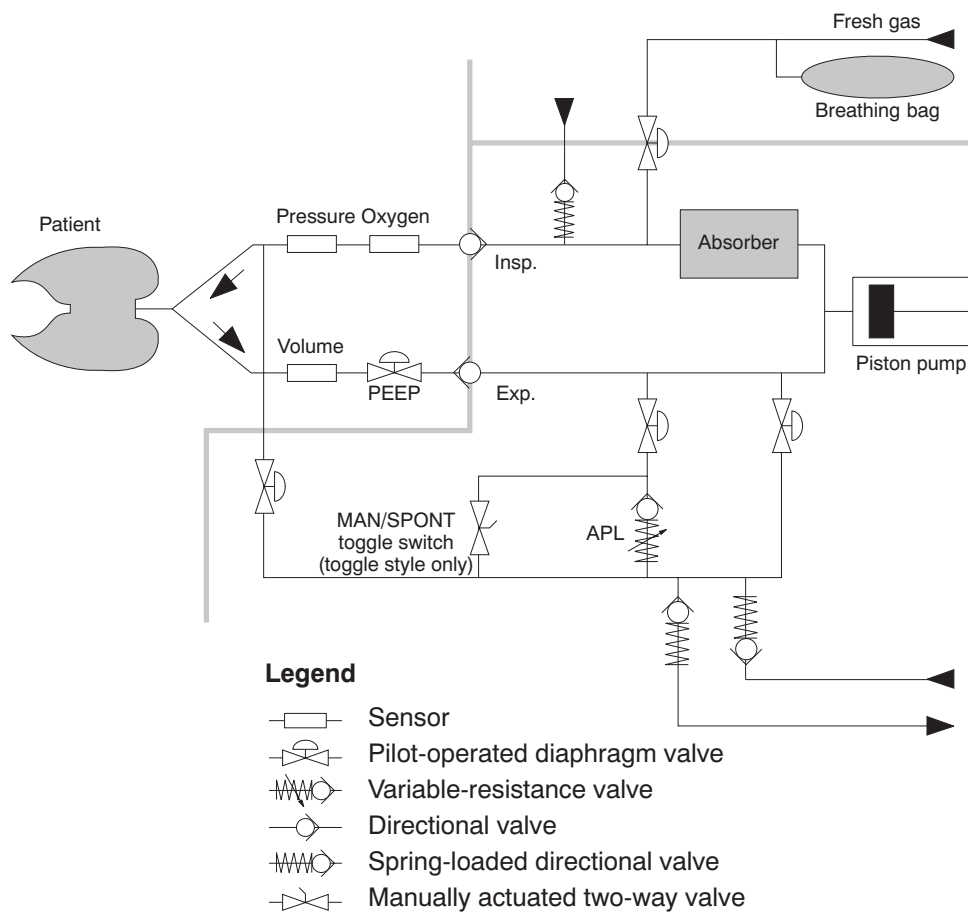
Leak Detection

By automatically checking for leaks in the breathing system and hoses, the ventilator helps to ensure minimal airway leakage, particularly important during low flow anesthesia.

Compact Breathing System

The compact breathing system directs the flow of patient gas using diaphragm valves automatically opened and closed by a control module. It contains the remainder of the Narkomed 6400 pneumatic interfaces and a re-usable absorbent canister. Figure 2-15 presents a simplified diagram of the ventilator pneumatic component systems and their relationship with each other. Figure 2-16 shows the location of the breathing system components. Figure 2-17 shows the connections of the compact breathing system to the patient hoses and to the Narkomed 6400.

The compact breathing system provides enhanced pediatric and low flow performance by minimizing the potential for leaks from connections and reducing total volume. The breathing system is also heated to prevent condensation of moisture in the system and provide a warm, humidified gas to the patient.



OP00051

Figure 2-15. Simplified Schematic of Breathing System Pneumatic Subsystems

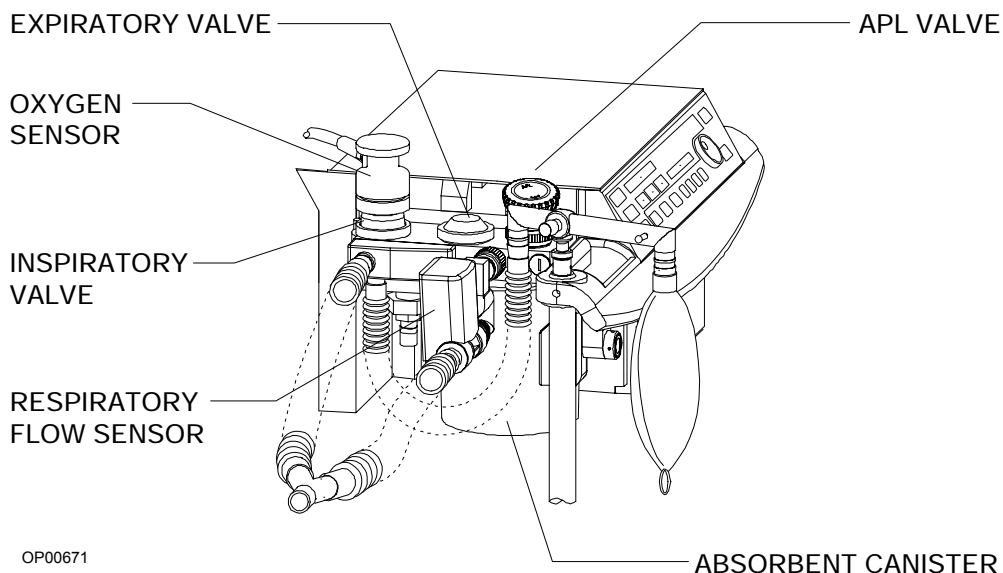


Figure 2-16. Compact Breathing System Components

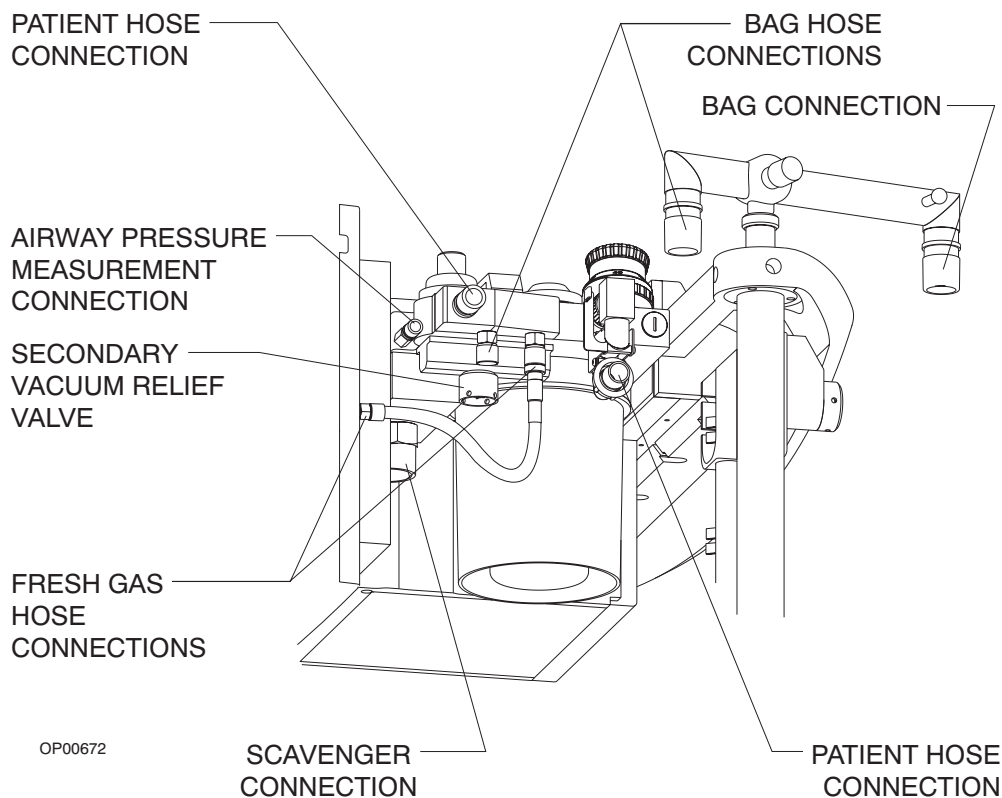


Figure 2-17. Compact Breathing System Connections

2

System Description

Inspiratory and Expiratory Valves

The ventilator has two 22 mm connectors for connecting standard inspiratory and expiratory patient hoses to the ventilator. Other system components, such as patient airway filters, may be mounted here.

Pneumatic Connectors

The ventilator has fittings for fresh gas inlet, breathing bag, airway pressure measurement, and exhaust of excess patient gas to the scavenger.

Absorber

The absorber is a single canister system for absorbing exhaled carbon dioxide in the rebreathing circuit. The re-usable absorber canister uses loose, granular soda lime absorbent. Design of the Narkomed 6400 permits easy access for inspection or service of the canister from the front of the machine.

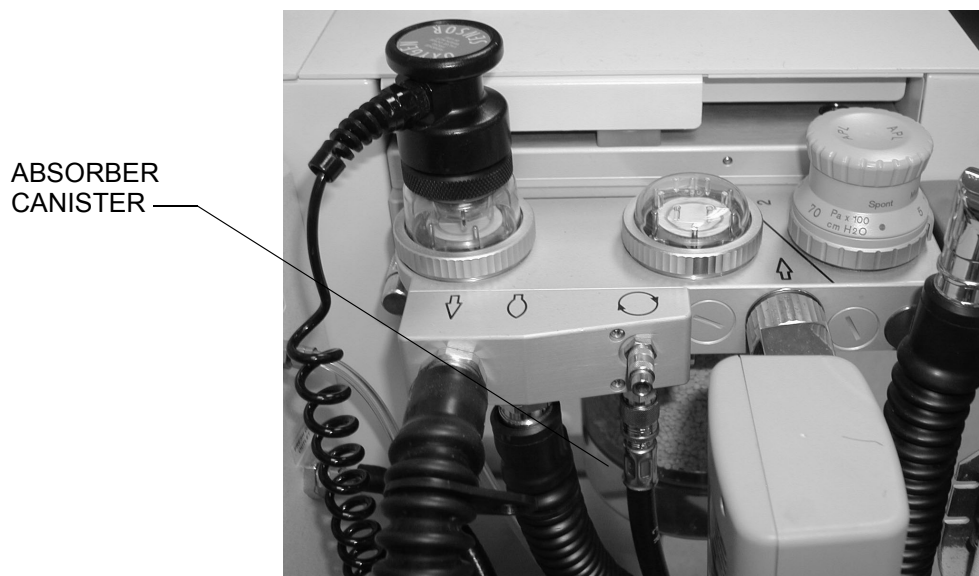


Figure 2-18. Location of Absorber Canister on Ventilator

APL Valve

Note: Your Narkomed 6400 may be equipped with either the knob-style or the toggle-style APL valve. Operational instructions are provided for both style valves throughout the manual. However, with the exception of Figure 2-20, all illustrations of the APL valve in this manual show the knob-style APL valve to avoid duplication of illustrations.

The APL valve, also known as the pop-off valve, has two functions. It limits the maximum pressure during manual ventilation. It also exhausts excess gas into the scavenger system during manual and spontaneous ventilation.

The APL valve is connected to the patient airway through the ventilator. It functions only when the ventilator is in Manual/Spontaneous Mode, safe state, or ventilator override condition.

Knob-Style APL Valve

The knob-style APL valve has an adjustment knob used to select either spontaneous or manual modes of ventilation. The adjustment knob is labeled to indicate approximate pressure settings.

For spontaneous ventilation:

Pressure is released for spontaneous ventilation when the APL valve adjustment knob is rotated fully counterclockwise to **Spont** position (the index mark on the knob will line up with the index mark on the bottom of the APL valve). Spontaneous ventilation automatically eliminates resistance to patient exhalation.

For manual ventilation:

In manual mode (**Man** position), the APL valve adjustment knob can be rotated to change the approximate pressure at which gas will flow through the valve and into the scavenging system. Clockwise rotation of the APL valve knob increases the pressure, and counterclockwise rotation of the APL valve knob decreases the pressure. Pulling up on the APL valve knob will temporarily relieve pressure.



Figure 2-19. Ventilator APL Valve (Knob-Style)

Toggle-Style APL Valve

The toggle-style APL valve has a toggle switch for selecting between manual and spontaneous modes of ventilation. When the side of the switch marked **MAN** is up, the APL valve sets maximum pressure for manual ventilation. When the side marked **SPONT** is up, pressure is released for spontaneous ventilation. Depressing the switch while in the **MAN** position will also temporarily relieve pressure.

Maximum pressure adjustment is made by rotating the APL valve adjustment when the toggle switch is in the **MAN** position to set peak airway pressure. The adjustment housing is labelled to indicate pressure settings. Rotating the adjustment counterclockwise reduces the peak inspiratory pressure and the pressure at which gas is released to the scavenging system. Rotating the adjustment clockwise increases the peak inspiratory pressure and the pressure at which gas is released to the scavenging system.

During spontaneous ventilation resistance to patient exhalation is automatically eliminated by toggling to the **SPONT** position, which eliminates the need to re-adjust backpressure.

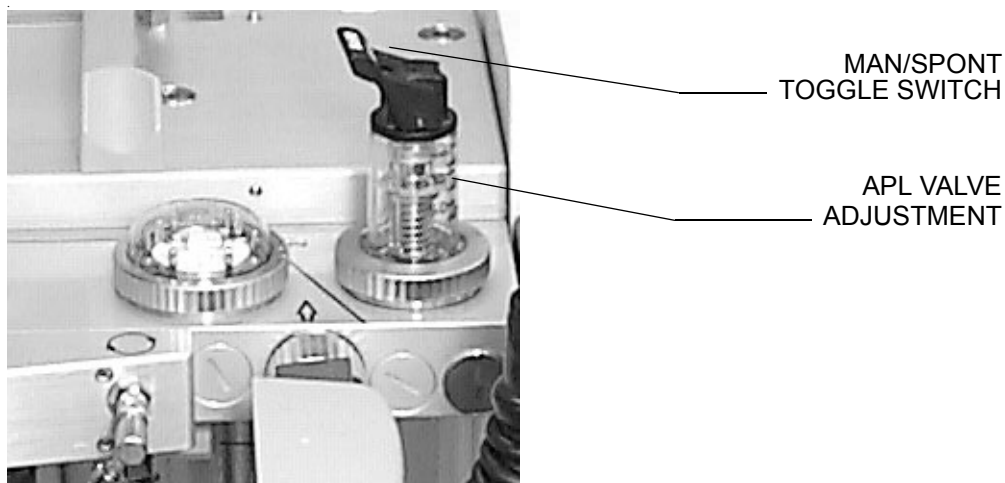


Figure 2-20. Ventilator APL Valve (Toggle-Style)

Bag Mount Arm

The bag mount arm rotates to facilitate ergonomic positioning of the breathing bag in an efficient position. The height of the bag can also be adjusted and locked in place by tightening the lock knob. For the convenience of the clinician, a 15 mm plug is provided for occluding the Y-piece, which is required during the self test or the leak and compliance test.

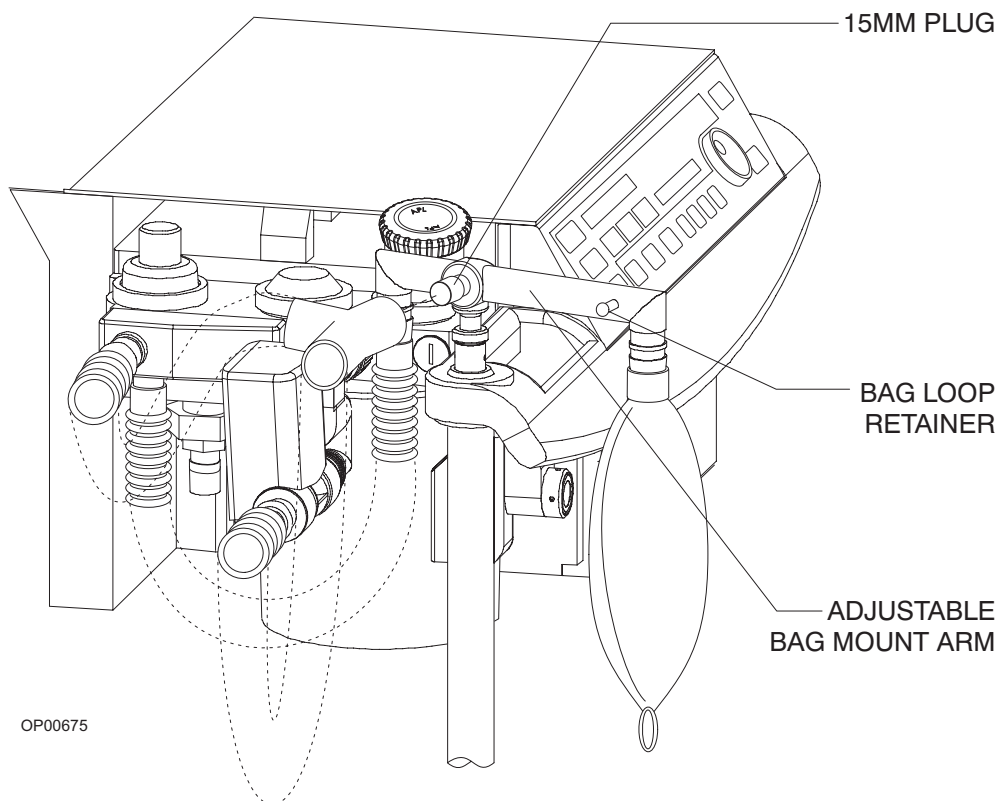


Figure 2-21. Bag Mount Arm

Piston Assembly

The ventilator piston assembly is found by opening the ventilator top cover. See “Ventilator Component Details” on page 17 of this section for a top view of the piston assembly. It contains a mechanically driven piston that controls the amount of gas delivered to the patient during mechanical ventilation. The piston assembly delivers gas via an electrically-controlled motor drive, as compared with the gas-driven bellows found in older types of ventilators. This feature allows for more accurate control of tidal volume delivery while minimizing compressible volume and waste of drive gas. Mechanical integrity is maintained with rolling seal diaphragms.

Ventilator Control Panel

Configuration and use of the ventilator is accomplished through the operator control panel, located on the front of the ventilator. See “Control Panel Functional Groups” on page 19 of this section for an overview. The panel provides display windows and control buttons for selecting parameter settings, ventilation modes, **Ventilator Standby**, and test operation.

Display Windows

Display windows inform the clinician about piston movement, current ventilator settings, operator prompts, device status, and errors. The ventilator does not display any measured patient parameters, which are available on the Narkomed 6400 monitor screen.

Bar Graph Display

The bar graph, located in the top left corner of the panel, is a indicator of piston movement during inspiration and expiration. It displays a percent of the value set for tidal volume. The 0% indication means full exhalation. The 100% indication means full inhalation. The indicator will not reach 100% during inhalation if the ventilator has not reached the full preset tidal volume setting.

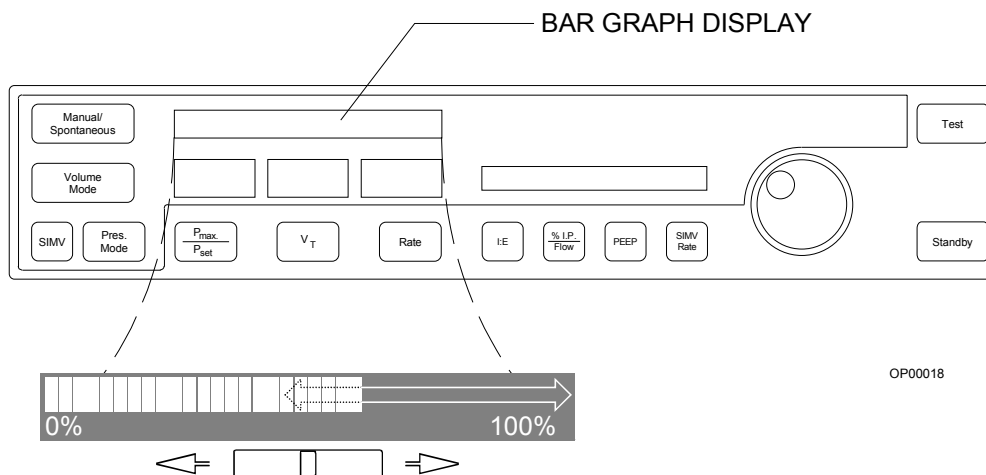


Figure 2-22. Location of Piston Movement Indicator (Bar Graph Display)

Numeric Display

Three numeric displays, located just below the bar graph indicator, show current settings for maximum allowable pressure (P_{max}) or preset airway pressure (P_{set}) in cmH₂O, tidal volume in milliliters or liters (V_T), and breathing rate in breaths per minute (Rate). The numbers displayed correspond with the settings for the parameter buttons located directly below them.

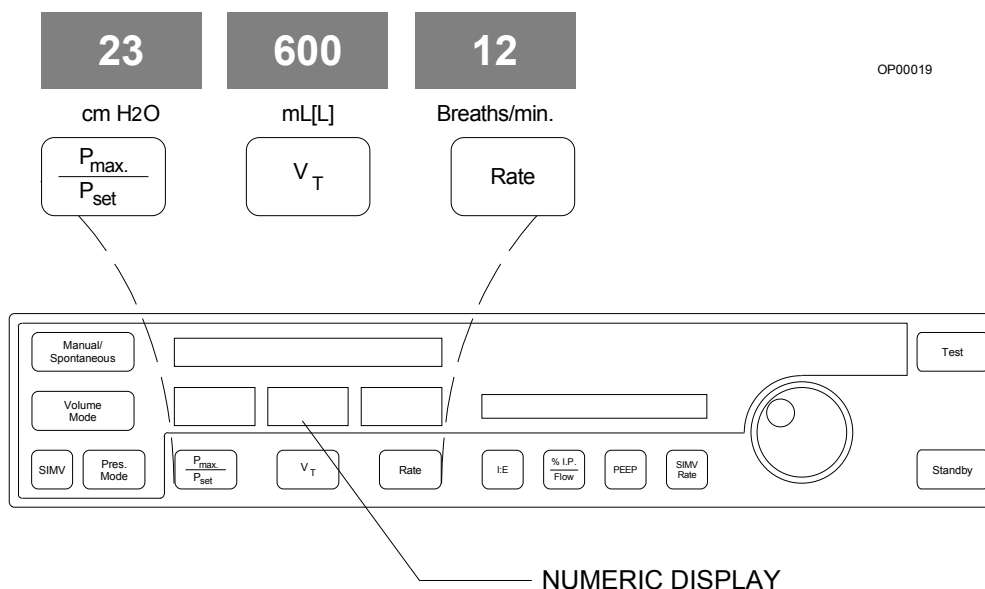


Figure 2-23. Location of Ventilator Pressure, Volume, and Rate Numeric Displays

Activation of numeric displays depend upon the ventilation mode selected by the clinician:

- maximum allowable pressure (P_{max}) will always be displayed in Volume Mode or Synchronized Intermittent Mandatory Ventilation (SIMV) Mode
- preset tidal volume (V_T) will always be displayed in Volume Mode or Synchronized Intermittent Mandatory Ventilation (SIMV) Mode
- preset airway pressure (P_{set}) will always be displayed in Pressure Mode
- breathing rate in breaths per minute (Rate) will always be displayed in Pressure Mode or Volume Mode.

2

System Description

Alphanumeric Display

An alphanumeric display, capable of holding 16 characters, is located to the right of the bar graph and numeric displays.

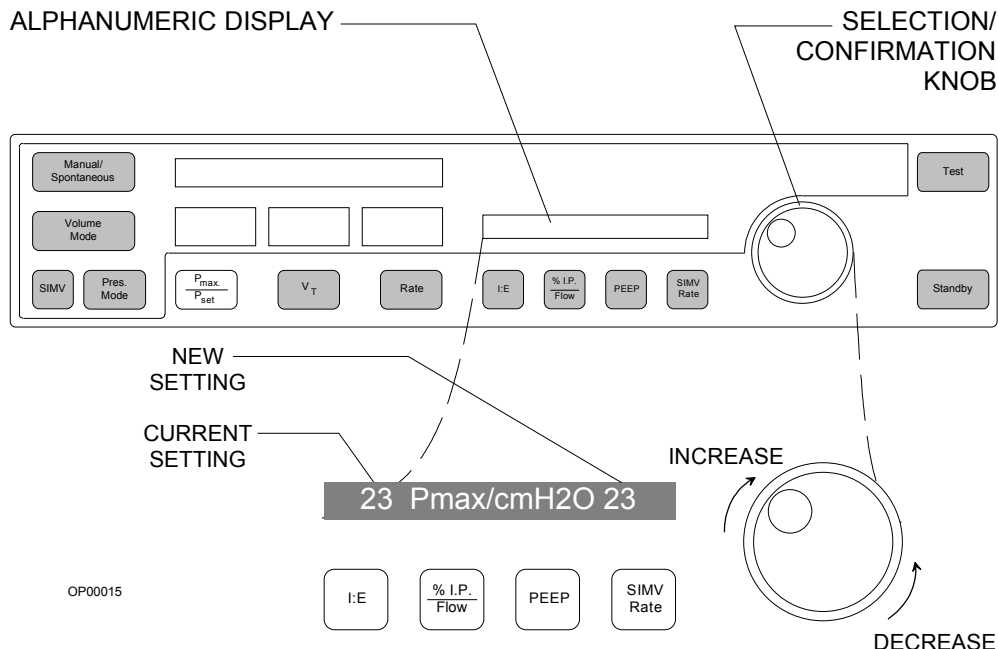


Figure 2-24. Location of Ventilator Alphanumeric Display

The alphanumeric display provides the following types of messages:

- messages prompting the clinician to set appropriate conditions and take specific actions during initial self-test and during normal operation
- messages reporting status and faults
- messages prompting the clinician to confirm changes to ventilator mode or parameter settings
- error messages, displayed in the event of an abnormal condition.

Selector/Confirmation Knob

Rotating the selector/confirmation knob changes a parameter setting after the parameter has been selected by pressing the appropriate button. Rotating the knob clockwise increases the setting. Rotating the knob counterclockwise decreases the setting.

Pressing the selector/confirmation knob confirms changes in mode or parameter settings and confirms and/or clears prompts. After the clinician presses the selector/confirmation knob, an audible tone is sounded (if enabled) to acknowledge the change in settings.

Ventilation Mode Buttons

The clinician selects the type of ventilation control method by pressing a ventilation mode button and then confirming the choice. Each button has an indicator light that energizes when the mode is achieved. The light flashes when the mode is selected. If the selector/confirmation knob is not pressed within 10 seconds, the light is extinguished and the ventilator continues in the previously selected mode.

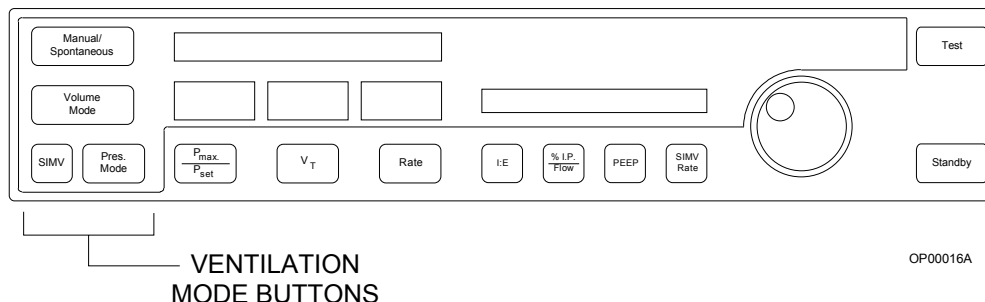


Figure 2-25. Ventilator Mode Buttons

Ventilation Mode Button	Action When Confirmed
[Manual/Spontaneous]	bypasses mechanical ventilation to deliver gas volume via a breathing bag or through the patient's spontaneous breaths
[Volume Mode]	sets time-cycled, volume-controlled mechanical ventilation
[SIMV]	synchronizes mechanical ventilation with patient's breathing efforts through Synchronized Intermittent Mandatory Ventilation (SIMV)
[Pres. Mode]	sets time-cycled, pressure-controlled mechanical ventilation

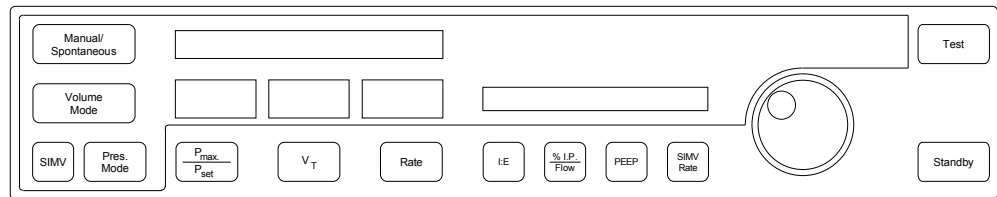
2

System Description

Parameter Setting Buttons

Parameter setting buttons are used with the alphanumeric display and selector/confirmation knob to change operating parameters for the ventilator.

Pressing the button once sends the current setting to the alphanumeric display. Rotating the selector/confirmation knob changes the displayed setting.



OP00016

PARAMETER SETTING BUTTONS

Figure 2-26. Ventilator Parameter Setting Buttons

Parameter Setting Button	Action When Confirmed
[Pmax/Pset]	sets the maximum allowable breathing pressure in Volume and SIMV Modes; sets the airway control pressure for Pressure Mode
[Vt]	sets the control tidal volume in Volume and SIMV Modes
[Rate]	sets ventilation frequency as breaths per minute in Volume and Pressure Modes
[I:E]	sets the ratio of inspiratory to expiratory time in Volume, Pressure, and SIMV Modes
[% I.P./Flow]	sets the ratio of inspiratory pause time to inspiration time in Volume and SIMV Modes; sets the inspiratory flow rate in Pressure Mode
[PEEP]	sets the positive end-expiratory pressure in Volume and Pressure Modes
[SIMV Rate]	sets minimum ventilation frequency in SIMV Mode

Ventilator Standby Button

Pressing the **[Standby]** button and confirming the choice sets the ventilator to **Ventilator Standby**, which minimizes drive gas use and allows for inspection or repairs when a patient is not being ventilated.

Test Button

Pressing the **[Test]** button initiates a ventilator test to measure system compliance and leakage. This test can only be initiated when the ventilator is in **Ventilator Standby** status. The Y-piece must be occluded to successfully complete the test. Fresh gas flow should be adjusted to minimum.

Ultrasonic Flow Sensor

An ultrasonic flow sensor measures respiratory flow rate. The velocity and flow rate of gas through the patient circuit are determined by measuring the differential time of flight of ultrasonic pulses transmitted upstream and downstream in the airway flow path. Flow measurements are independent of gas concentration and yield precise values with all normal anesthetic gases except Heliox.

The following figure illustrates the flow sensor assembly installed in the Narkomed 6400. The flow sensor housing connects to the patient circuit at the expiratory valve fitting. Two transducers (sensors) sense the differential time of flight. The electronics assembly controls the transducers, processes the data, and provides output to the Narkomed 6400 through a sensor cable that connects through the breathing system interface panel. A lever secures and releases the electronics assembly from the flow housing and transducers.

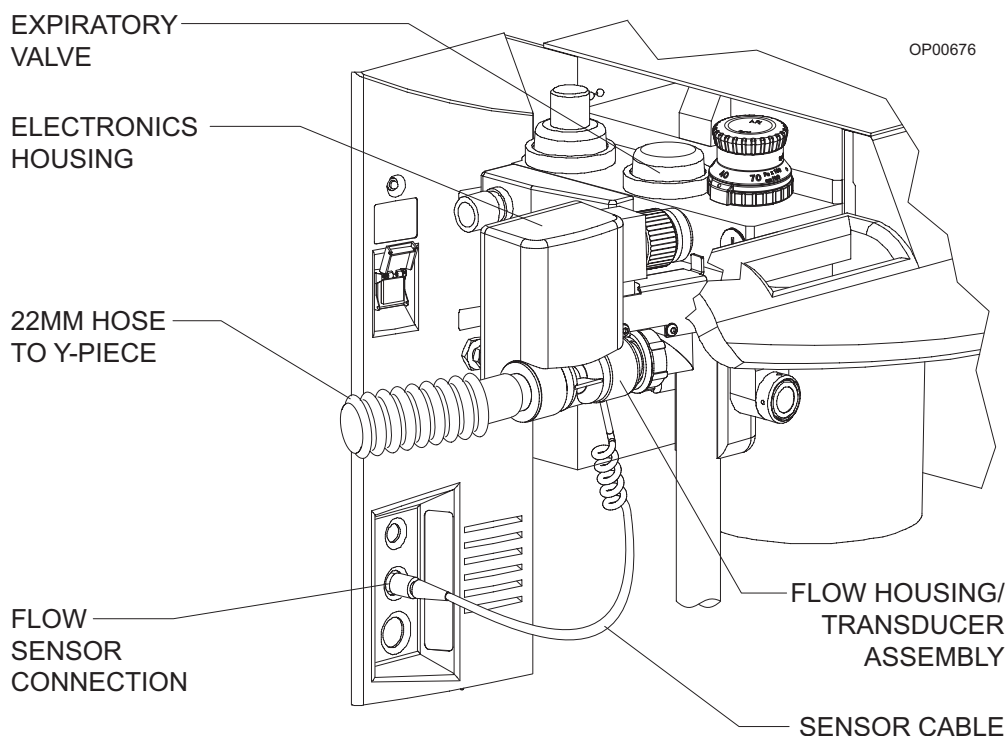


Figure 2-27. Narkomed Ultrasonic Flow Sensor

Flow sensor output is used by the Narkomed 6400 processor to calculate and display numeric values for tidal volume, minute volume, and rate, as well as the respiratory volume waveform display.

When the system power switch on the Narkomed 6400 is turned on, power is supplied to the flow sensor. On power-up, the flow sensor performs a self-diagnostic test.

Breathing System Pressure Gauge (CUSTOMER OPTION)

The Narkomed 6400 can be equipped with a mechanical pressure gauge to enable quick visual determination of breathing circuit pressure. The gauge is marked for measurements from -20 to +80 cm H₂O in increments of 2 cm H₂O. This gauge is an option that is available in addition to the standard software pressure gauge that can be displayed on the Narkomed 6400 screen.

The gauge is mounted on the side of the anesthesia machine and connects to the breathing system interface panel.

Warning: To prevent leaks, make sure that the T-fitting joining the breathing pressure pilot line and the pressure gauge hose is securely connected to the breathing system interface panel.

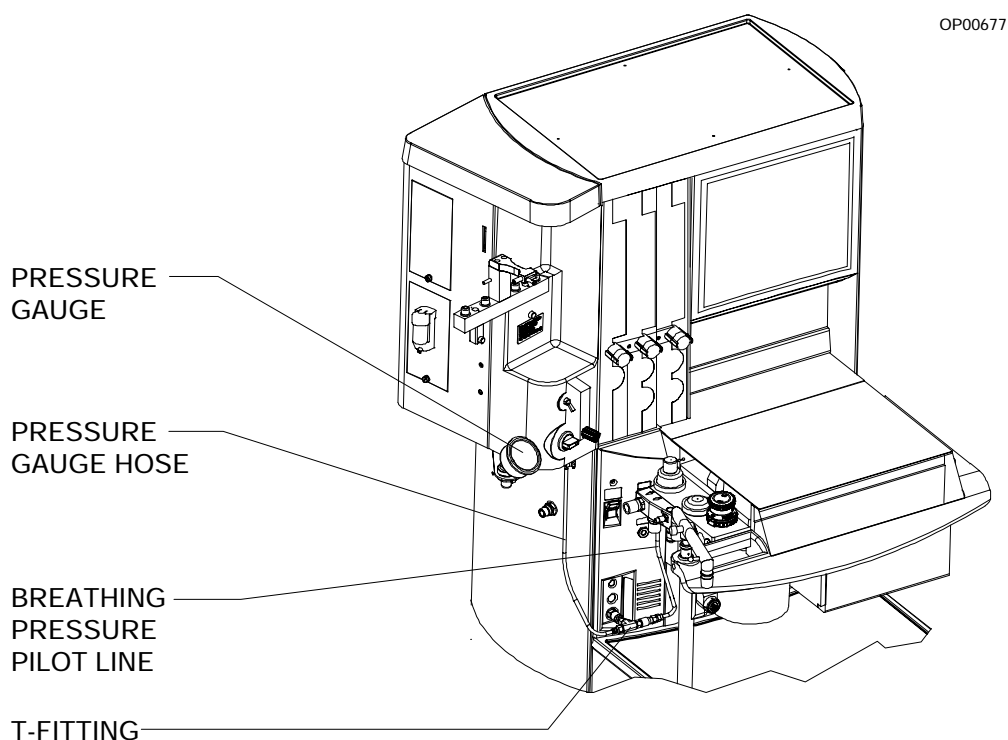


Figure 2-28. Breathing System Pressure Gauge and Connections

Scavenger Systems (CUSTOMER OPTION)

The Narkomed 6400 can be equipped with one of two kinds of scavenger systems for the best match with the facility's waste gas disposal system.

Open Reservoir Scavenger

The open reservoir scavenger is used with suction (vacuum) waste gas disposal systems. This scavenger is an "open" system with continually open relief ports for positive and negative pressure control. The scavenger flowmeter is easily examined during operation.

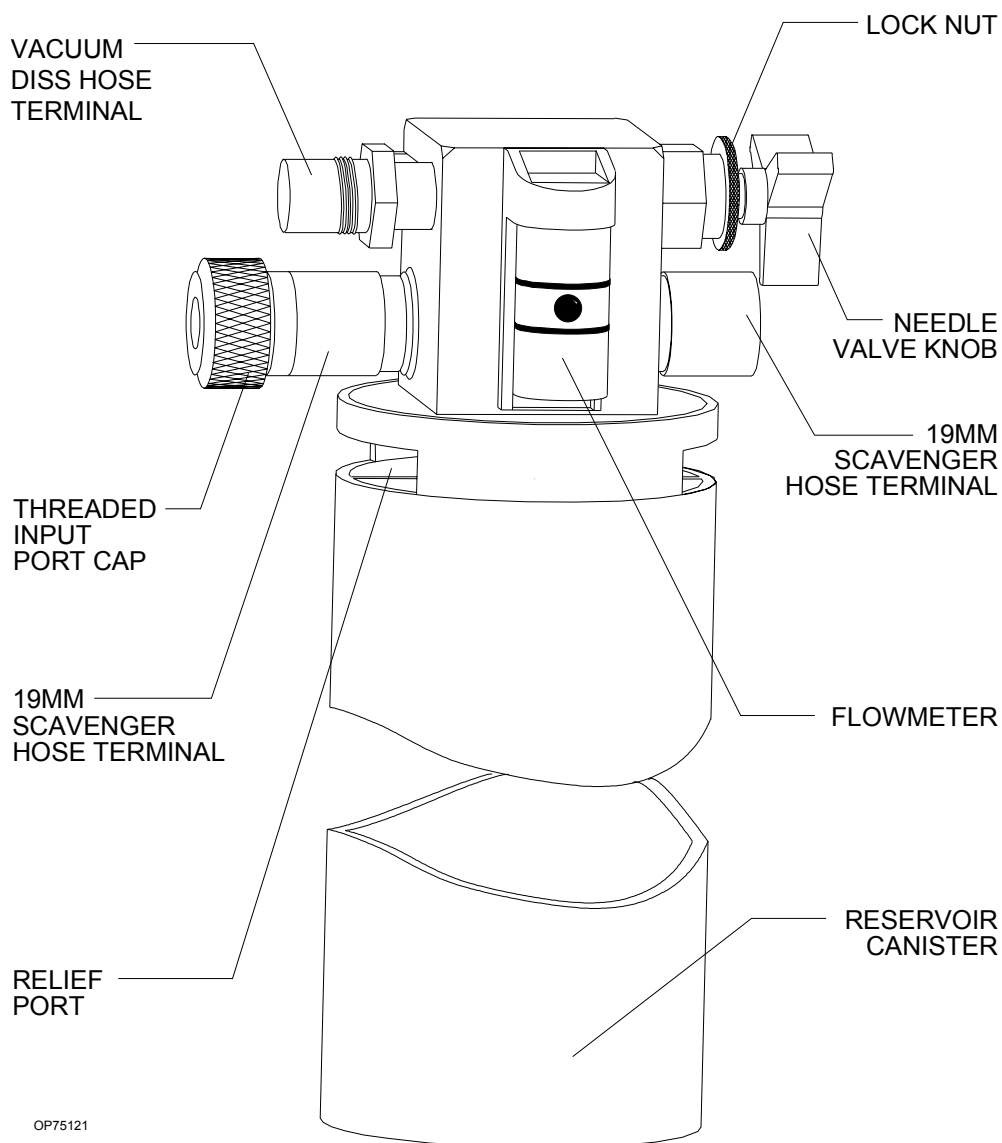


Figure 2-29. Open Reservoir Scavenger

Scavenger Interface for Passive Systems

The scavenger interface for a passive system is used only with nonrecirculating ventilation (exhaust) systems. This scavenger is a “closed” system with a spring-loaded valve for positive pressure relief. It is not meant to be used with suction disposal systems.

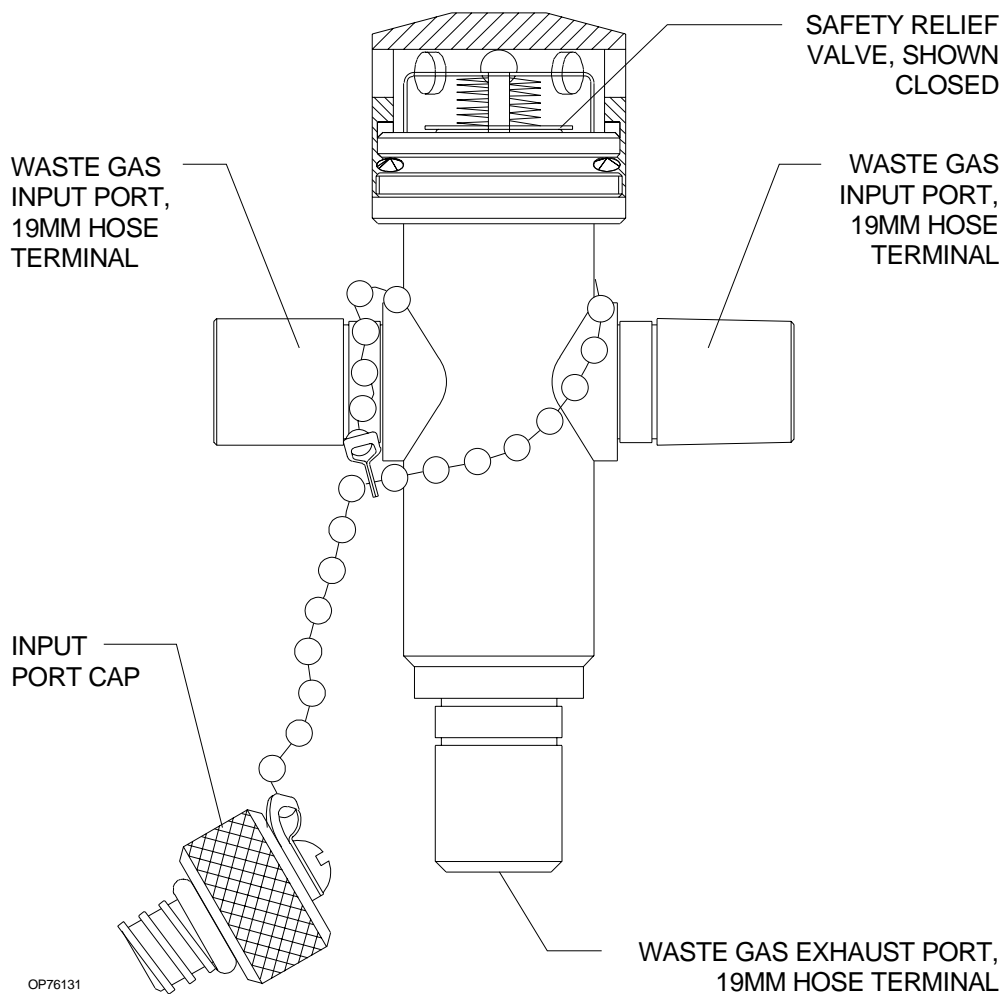


Figure 2-30. Scavenger Interface for a Passive System

Power Supply System

The Narkomed 6400 has a central power supply for the ventilator, alarm system, and monitoring system. This design permits operation with only one AC power cord, a safety feature. No subsystem, including the monitor, has a separate **ON/OFF** switch. The following block diagram illustrates both the power supply and feedback from the monitoring systems.

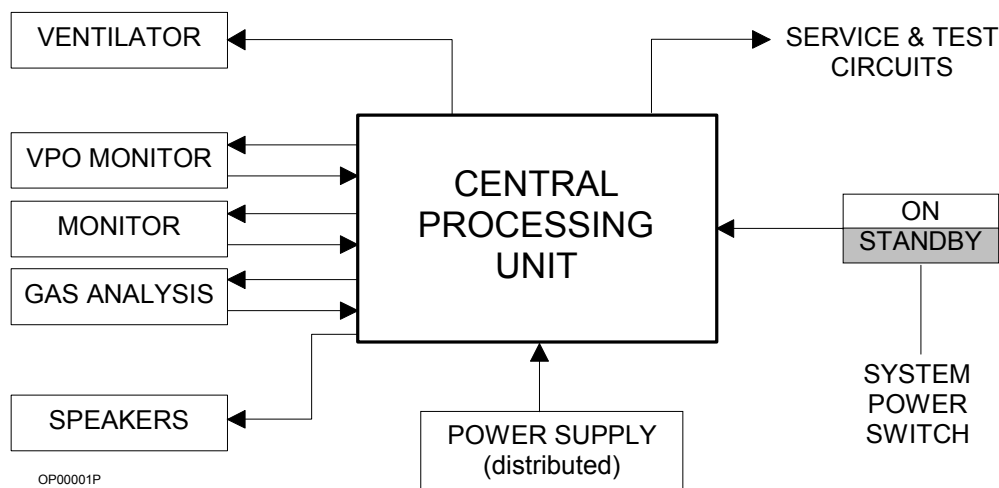


Figure 2-31. Power Supply and Feedback from Monitoring Systems

System Power Switch

The system power switch has two positions — **ON** and **STANDBY**. The following table provides a summary of system components and functions activated by the **ON** and **STANDBY** positions. When the power switch is in the **STANDBY** position, this manual also refers to operating status as **System Standby**.

Electrical / Pneumatic Circuit	Power Switch in ON Position	Power Switch in STANDBY Position
convenience outlet	energized	energized
Narkomed 6400 warm-up	energized	energized
O ₂ flush	energized	energized
auxiliary O ₂	energized	energized
battery charging circuit	energized	energized
reserve power system	energized	energized
ventilator gas and electric power circuits	energized	OFF
ventilator control panel	energized	OFF
Narkomed 6400 monitor	energized	OFF
alarms	energized	OFF

2

System Description

Electrical / Pneumatic Circuit	Power Switch in ON Position	Power Switch in STANDBY Position
manual ventilation during primary and reserve power failure	energized	OFF
gas supplies (except oxygen)	energized	OFF

Convenience Outlet

The Narkomed 6400 has one convenience outlet, located on the rear of the machine. The outlet is active when the Narkomed 6400 is plugged into an outlet, whether or not the system power switch is turned on. A circuit breaker protects the outlet. The total current for any device plugged into the outlet must not exceed 2.5 amps.

Circuit Breakers

The electrical system includes three circuit breakers to protect machine functions. The circuit breakers are located at the bottom rear of the machine. The three breakers are labeled as follows:

- AC main
- batteries
- convenience outlet.

When the plunger is flush with the surface of its base, the circuit breaker is in its normal, closed position. A circuit breaker is open (tripped) when its plunger extends beyond its base. If a breaker is tripped, the cause must be found and corrected before using the Narkomed 6400.

Reserve Power System

The reserve power system consists of rechargeable batteries and a built-in battery charging system, along with the interlock system that activates it during primary power loss. At least 30 minutes of reserve power is available.

Although most hospitals have emergency generators that provide AC power when line power fails, a delay may occur before generator power comes online. The reserve power system automatically provides power during the period between line power failure and activation of the hospital's emergency generator. It also provides power if the power cord is accidentally unplugged during a case.

When the hospital's emergency generator comes online (or when a disconnected power cord is reconnected), the Narkomed 6400 automatically switches back to AC power and recharges its battery. The battery charging system charges the battery any time the power cord is connected to an active AC power source. The charger can recharge a fully discharged battery in about 12 hours.

If the battery is not fully charged, a **BATTERY LOW** alarm will be displayed. This alarm means that there are about 10 minutes of battery power remaining when the advisory first appears.

Machine Functions on Reserve Power

If the primary AC power fails, the reserve power system is activated. All monitoring functions continue for at least 30 minutes when the battery is fully charged.

An **AC POWER FAIL** advisory will be displayed when the reserve power system is activated. In addition, at any time that the Narkomed 6400 detects an AC power loss, the following dialog box is displayed on the screen, an audible alarm is sounded, and the system exits **Monitor Standby** (if the system was in **Monitor Standby** at the time of the power loss). The clinician must touch the **[OK]** button to remove the dialog box from the screen.



Figure 2-32. AC Power Not Applied Dialog Box

When the battery charge is nearly exhausted following an AC power loss, an **AC/BATTERY FAIL** caution alarm will occur. This alarm signifies that about 10 minutes of reserve power remains.

When reserve power is cut off, the gas supply system continues to function. However, mechanical ventilation is not possible. Ventilation must be performed manually. Once battery charge is exhausted, the Narkomed 6400 cannot provide monitoring or alarm functions until AC power is restored.

Monitoring System

The monitoring system integrates the functions of ventilation and gas monitoring into a high-resolution color touch screen display with real-time data, waveforms, trends, and alarms.

Pressing a finger or other object such as a pen or stylus on a control button or other target area activates the touch screen to initiate processor response to the clinician's input. Usually the system permits change to the selection after removing the finger from the screen. However, scroll bars and slider controls change values while the finger is touching the screen. Touching the screen anywhere while in **Monitor Standby** activates a dialog box where the clinician may initiate monitoring a new case, resuming an ongoing case, or re-selecting **Monitor Standby**.

Service software performs span and zero calibrations for the airway pressure monitor, zero calibration of the oxygen monitoring system, and flow calibration for the gas analysis pod. In addition, the service software maintains a log of conditions observed by the monitors, including any faults detected during diagnostics.

Colors in the displays are not configurable by the clinician. Consistent colors have been programmed to appear on labels, sublabels, units of measure, alarm limits, numeric value(s), waveforms, and trend graphics for a given parameter. The color and location for each monitoring parameter are presented in the following table.

Parameter	Color	Parameter Box Position
Pressure	yellow	top
Volume	blue	2nd
Agent/N ₂ O (no agent identified)	peach	3rd
- Halothane/N ₂ O	red	3rd
- Isoflurane/N ₂ O	purple	3rd
- Desflurane/N ₂ O	blue	3rd
- Enflurane/N ₂ O	orange	3rd
- Sevoflurane/N ₂ O	yellow	3rd
Carbon Dioxide (CO ₂)	white	4th
Oxygen (O ₂)	green	bottom

Main Screen

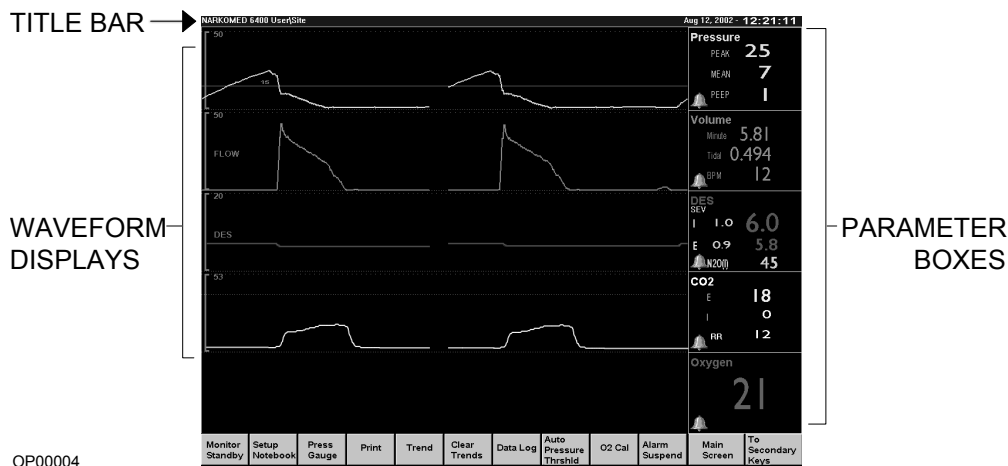


Figure 2-33. Main Screen Display Areas and Controls

Monitoring the operation of the Narkomed 6400 takes place on the main screen, which consists of the following display areas:

Display	Monitoring Function
Waveforms	show four real-time physiological waveforms, or traces, next to their associated parameter boxes
Parameter boxes	display values for physiological data and an alarm icon; during a case setup or system configuration the clinician accesses a popup parameter notebook related to the specific display. Because there is no associated trace, the parameter box for oxygen is located at the bottom of the column of parameter boxes <i>Example:</i> The CO ₂ parameter box displays the amount of CO ₂ (in user selected units) analyzed from a patient's inspiratory and expiratory samples and an alarm that annunciates at clinician-set limits.
Title bar	shows current date and time (in 24-hour format), displays any active timers, and indicates template name (if any).
Control buttons	(primary or secondary keys) perform specific functions indicated by the name of the button, located in a taskbar at the bottom of the main screen. See "Main Control Buttons" on page 3-7 for a complete listing.

The text or appearance of some main control buttons changes after performing an action. The label on main control buttons always reflects the action that the clinician can make if the button is touched, *not* the current status. Control buttons used to display notebooks or data windows change to a darker background color when touched and will remain dark as long as the display is active. Control buttons that perform a momentary function will appear darker for approximately three seconds after being touched to acknowledge the clinician's action.

Monitor Standby	Setup Notebook	Press Gauge	Print	Trend	Clear Trends	Data Log	Auto Pressure Thrshld	O2 Cal	Alarm Suspend	Main Screen	To Secondary Keys
-----------------	----------------	-------------	-------	-------	--------------	----------	-----------------------	--------	---------------	-------------	-------------------

Figure 2-34. Taskbar Showing Main Control Buttons (Primary Keys)

Template		Respi-tone®	Vent Info Notebook	Low Flow Wizard	Limits Autoset	Utilities Notebook	Auto Pressure Thrshld	O2 Cal	Alarm Suspend	Main Screen	To Primary Keys
----------	--	-------------	--------------------	-----------------	----------------	--------------------	-----------------------	--------	---------------	-------------	-----------------

Figure 2-35. Taskbar Showing Main Control Buttons (Secondary Keys)

Additional user-selectable or system response windows may appear on the main screen during operation:

Display	Monitoring Function
Parameter notebook window	displays specific selections available and their current values
Alarm window	lists system status messages, advisories, cautions and warnings
Trend window	displays graphic trend information of the waveform data
Data log window	displays numeric trend information in a tabular form
Dialog boxes	display messages that may require responses from the clinician
Hint Messages	indicate why an expected action cannot be taken

Waveform Displays

The waveform displays are real-time data gathered from the measurement subsystems and processed by the Narkomed 6400 processor. Scale labels and reference lines appear with all waveforms. The agent waveform also has a parameter label.

The waveform channel is the area in which a waveform is used. Four channels appear on-screen. Waveforms are not clipped, so a waveform may appear outside its waveform channel when data beyond the current waveform scale is recognized. The pressure and volume waveforms adjust scale automatically as required. The clinician may select the Agent/N₂O scale.

When a trend window or parameter notebook is selected, the width of the waveform area is decreased. They cannot be moved, but are easily closed to resume viewing the complete waveform display. Under other conditions, such as the appearance of a dialog box or an alarm window, the waveform display is partially covered. Dialog boxes require a clinician's response to remove them from the screen. The alarm window can be moved or resized anywhere on the waveform display area. Despite a smaller display area, the real time data is always visible.

Waveform displays are never slowed down, broken up, or stopped while the clinician makes changes to settings during a case.

Parameter Boxes

Parameter boxes are the means through which the clinician communicates with the Narkomed 6400 monitoring systems. They are aligned and to the right of their respective waveforms. Communication includes:

- identity of the waveform that appears to its left
- real-time numeric data for readings of patient-monitoring systems
- access to the associated notebook for choosing operation settings
- an alarm bell icon from which the clinician may choose **ON**, **OFF**, or **Alarm Standby** status
- measurement subsystem status; an **N/A** message indicates a disconnected pod or failed pod parameter
- alarm limits (user-selected)
- display of units of measure (user-selected).

The display in a parameter box changes color, depending upon operating circumstances. During system configuration and setup, that is, when a parameter notebook is open, the parameter box displays black text on a grey background. During normal operation with all parameter notebooks closed, the parameter box displays colored text on a black background. Data displays register physiological inputs to the parameter box within 0.4 second.

Parameter Notebooks

To open a parameter notebook, the clinician touches any area of the associated parameter box, except the alarm bell icon. A display resembling a notebook with pages and tabs appears in the right half of the waveform area. Each page shows specific selections available and their current values or status.

Note: If the alarm bell icon in any parameter box is touched, the notebook will not open. However, the alarm bell icon will indicate a new status, if applicable.

Example: The following figure shows the oxygen parameter notebook, accessed by touching the oxygen parameter box in the lower right-hand corner of the screen.

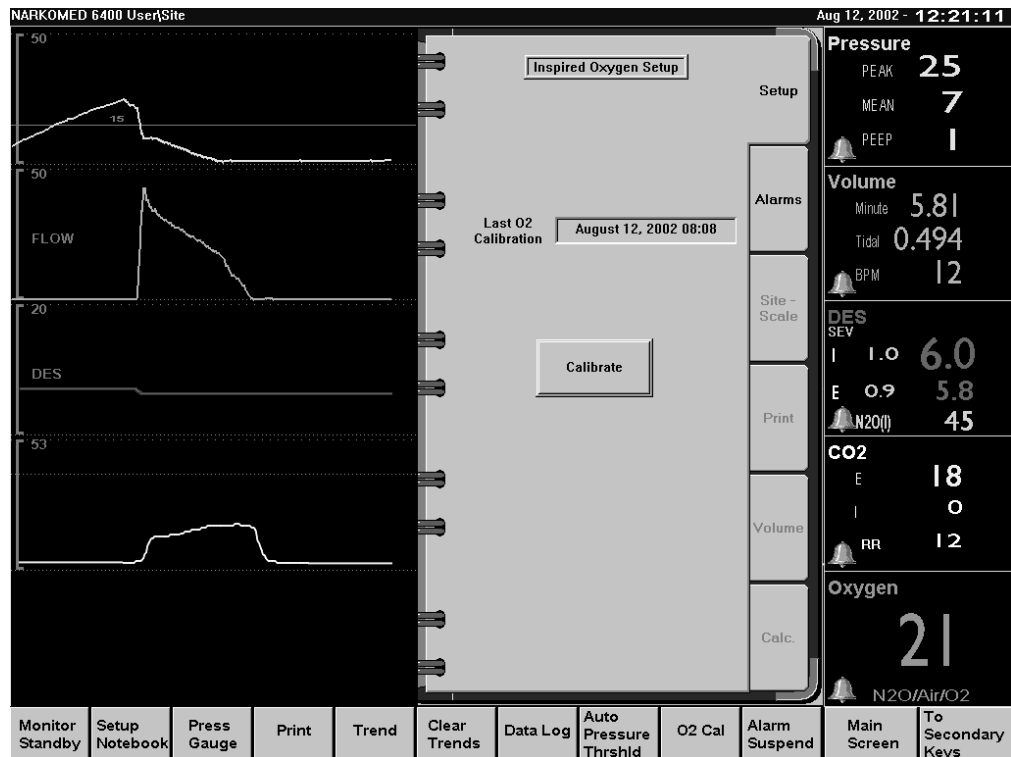


Figure 2-36. Accessing a Parameter Notebook

Parameter
Notebook
Tabs and
Pages

Parameter notebooks have six tabs, all touch-sensitive. The notebook opens, by default, on the Setup page. If the Setup page is inactive, then it opens on the Alarms page. The clinician touches a specific tab, as if it were a notebook index, to access other notebook pages:

Notebook Tab / Page	Monitoring Function
[Setup]	sets the primary settings and controls for operating parameters
[Alarms]	sets the alarm management settings
[Site-Scale]	sets controls for displaying site and scale
[Print] or [MAC Info] (agent notebook only)	available with a future release displays Minimum Alveolar Concentration (MAC) information
[Volume]	sets audible alarm volume adjustments
[Calc]	available with a future release

The tab arrangement is the same for each notebook, with the exception of the agent notebook which has the **[MAC Info]** tab in place of the **[Print]** tab. Some tabs may not be available if certain settings do not apply. In that instance, the tab is dimmed gray on the screen and cannot be selected.

Notebooks are closed by touching the associated parameter box, by touching the **[Main Screen]** control button, or by opening another notebook.

Each notebook page provides the means to set parameters and start programs using control buttons and slider bars.

Slider Bars

Slider bars are used to set parameters with a broad range of possible values, such as alarm settings and volumes. The position of the slider control inside the slider bar indicates the level between maximum and minimum settings. Settings are adjusted by dragging the slider bar while continuously maintaining contact with the screen. The new setting will become effective when contact with the screen is broken.

Monitor Standby

When the clinician confirms the selection of **Monitor Standby** status, the Narkomed 6400 immediately stops all monitoring functions and suspends the main screen. All data collection is stopped and alarms are suspended. The messages **MONITOR STANDBY, ALL ALARMS SUSPENDED** and **Touch Screen to begin Monitoring** are posted. Touching the screen anywhere while in **Monitor Standby** activates a dialog box where the clinician may initiate monitoring a new case, resume an ongoing case, or return to **Monitor Standby**.

Monitor Standby can only be entered if the DIVAN ventilator is in the Standby Mode, or if a Ventilator Communication error exists. If the clinician selects the Monitor Standby Key and the DIVAN is in either Volume, Pressure, SIMV, or Man/Spont Mode, a hint message will be displayed stating the following: "DIVAN Ventilator must be in the Standby Mode to enter Monitor Standby". If the Narkomed 6400 is in Monitor Standby and the DIVAN Ventilator is switched from standby to Volume, Pressure, SIMV, or Man/Spont, the NM6400 will resume the current case.

Since the monitor has no separate on/off switch, a screen saver screen, dimmed to prevent CRT screen burnout, is displayed during periods of inactivity during **Monitor Standby**. The screen saver appears after **Monitor Standby** has been active for 20 seconds .

2

System Description

Trend Window The Narkomed 6400 provides automatic data recording by compressing real-time data gathered from the waveforms and graphically displaying the resulting trend in the trend window. Data is sampled every 30 seconds, and a maximum of 24 hours of data is collected for display. The window is displayed to the left of the associated waveform and reduces the width of the waveform area.

The trend window may be partially blocked by the alarm window or the data log. The trend window will always be on top when it is selected after the data log. However, the alarm window remains on top.

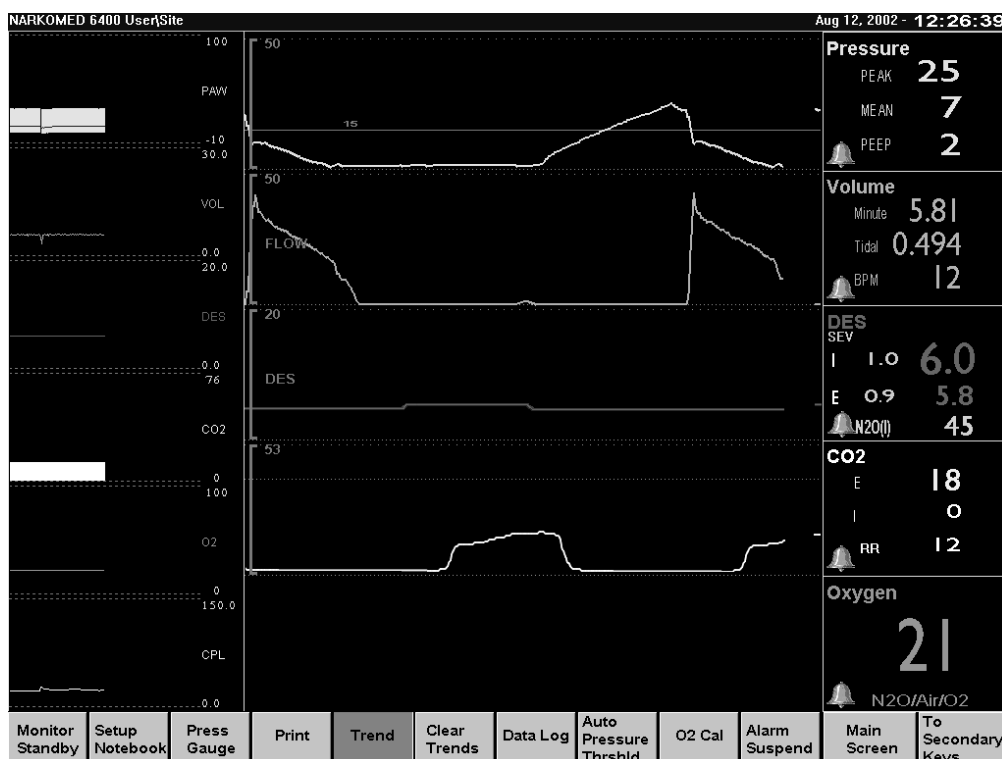


Figure 2-37. Trend Window

The colors in the trend graphics are the same as parameter box and waveform colors, depending upon the parameter displayed. For example, the pressure waveform and parameter box numbers are yellow; so is the corresponding trend display.

The lung compliance trend does not have a corresponding parameter box or waveform. It is displayed at the bottom of the screen in white.

Data Log

Additional automatic data recording is provided through the data log function. When selected, a data log spreadsheet appears on the screen, partially overlaying the waveform display. Recorded data is collected in intervals selected by the clinician.

The monitoring measures tracked in the data log are listed in “Data Log” on page 8-13.

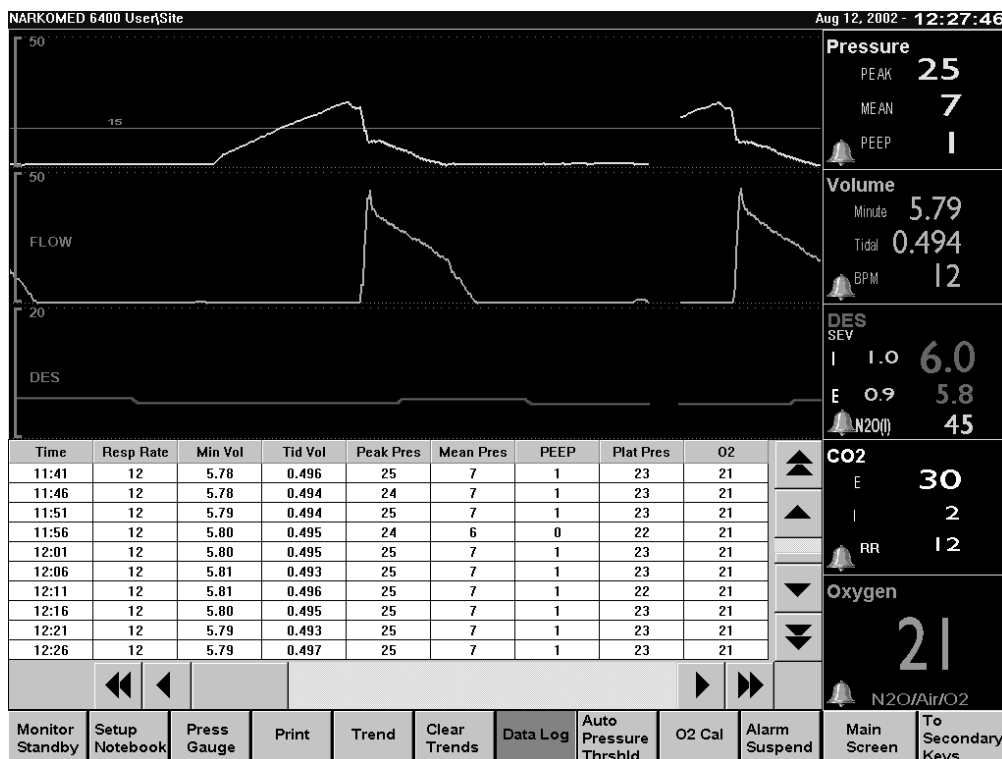


Figure 2-38. Data Log

Dialog Box

Dialog boxes are windows that prompt the clinician for confirmation of inputs, such as requests for clearing trends, monitor standby, oxygen calibration, or acknowledgment of inverse I:E ratio settings for the ventilator.

Alarm Window

The Narkomed 6400 displays messages concerning all active alarms in the alarm window. This window appears automatically in the waveform area of the screen when an alarm condition occurs. The alarm window itself can never be blocked by dialog boxes.

The window expands to accommodate new messages and condenses as alarm conditions are resolved. A maximum of fifteen alarms can be displayed simultaneously. If a sixteenth alarm occurs, the word MORE appears in the sixteenth alarm position. If there are no active alarms, the alarm window is automatically removed from the screen.

Whenever the alarm window reappears, it is located at the position last set by the clinician. The window may relocate vertically to accommodate new alarms, but when the alarms are removed, the window will again return to the position last set by the clinician.

Alarms are organized into three categories based on urgency – *warnings, cautions, and advisories*. Alarm messages appear in the order of urgency, each with a different color background. Within each priority, they are listed in order of occurrence with the most recent message at the top. Three distinct sound patterns announce the three types of alarm messages. When more than one alarm condition occurs, only the highest priority alarm sounds. See Section 9 and Appendix 1 for a complete discussion of audible alarm patterns.

An **[ALARM SILENCE]** control button appears at the bottom of the alarm window. Touching the **[ALARM SILENCE]** control button silences the audible alarms for 60 seconds if alarm silence is *not* in effect, and for 120 seconds if alarm silence *is* in effect. A countdown timer appears next to the button to indicate the number of seconds remaining in the alarm silence period. If no countdown timer appears, it means that alarm silence is not in effect.

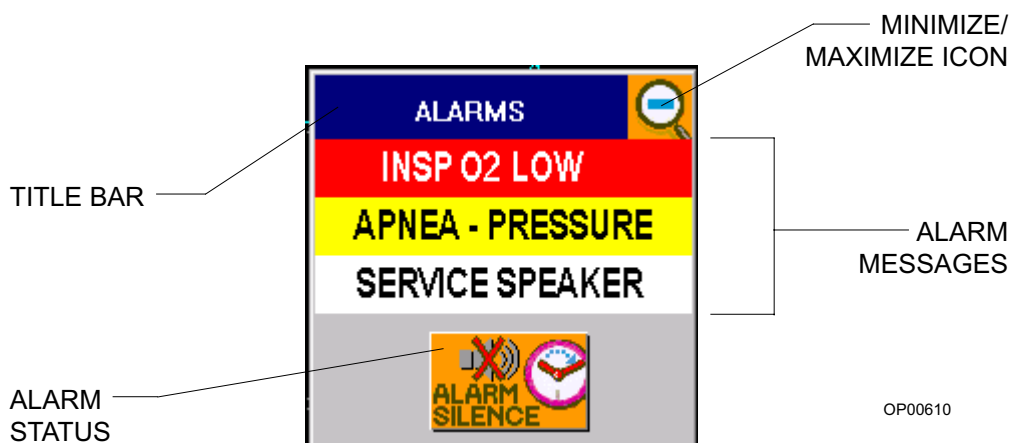


Figure 2-39. Alarm Window

The alarm window can be moved within the waveform area or its size changed. The magnifying glass icon in the upper right corner indicates the window sizing status. When the window is minimized, the system removes existing advisories and a plus sign overlays the icon. The system will display all advisories again if any new advisories occur. When the window is at full size, all alarm categories are displayed and a minus sign overlays the icon.

Hint Messages

Hint messages are small text boxes that appear when the clinician touches a key for which there is no response. The message explains why the clinician's action cannot be taken. For example, a hint message appears when the clinician touches the Monitor Standby Key when the DIVAN ventilator is not in standby.

Measurement Subsystems

Measurement subsystems are modules added to the Narkomed 6400 that obtain patient data for real-time display on the touch screen monitor. They are completely integrated with the monitoring systems, so the clinician need not be concerned with the subsystems. The subsystems used with the Narkomed 6400 will vary, depending on the configuration selected at the time of purchase. The basic subsystems provided with all Narkomed 6400 systems are the volume, pressure and oxygen (VPO) monitor and the gas analysis pod (GAP). The optional Integrated Patient Monitor (IPM) provides the Narkomed 6400 with additional patient monitoring capabilities. See the *Integrated Patient Monitor Option Operator's Manual* for complete information.

The VPO monitor evaluates real-time minute volume; tidal volume; respiratory rate, based on expiratory flow; peak, plateau, mean, and PEEP pressures; and inspired oxygen concentration.

The gas analysis pod monitors the real-time end tidal and inspiratory concentrations of:

- carbon dioxide
- nitrous oxide (inspiratory only)
- anesthetic agent
(Halothane, Enflurane, Isoflurane, Desflurane, and Sevoflurane).
- respiratory rate based on CO₂ fluctuations

The gas analysis pod uses a Dräger infrared gas bench to identify the agent used and notifies the clinician if more than one anesthetic agent is detected. The gas analysis pod provides data for the agent with the highest concentration, but warns the clinician that a mix is present.

The gas analysis pod also monitors a patient's inspiratory and end tidal CO₂ levels, using infrared analysis, which measures the absorption of infrared light. The amount of light absorbed varies with the concentration of CO₂. The absorption rate is measured and translated into a waveform and numeric values for mean CO₂ content (end tidal CO₂ and inspired CO₂) and respiratory rate.

A CO₂ waveform trace provides a means for a visual check of the patient's ventilation and of the patency of the patient breathing system. The study of the shape of the trace (capnography) can also provide diagnostic information about the patient's circulation and metabolism.

The VPO monitor evaluates the real time inspiratory oxygen concentration, expiratory flow, and breathing pressure.

The Narkomed 6400 monitoring system communicates with the gas analysis pod and VPO monitor simultaneously. If the processor loses communication with a subsystem, for example, if a sensor cord is disconnected, then the alarms associated with that subsystem disappear from the alarm window and only the disconnect message is displayed.

Note: When the oxygen sensor is reconnected, the Narkomed 6400 prompts the clinician to initiate a calibration, and oxygen alarms remain off until the calibration is successfully completed.

**Measurement
Pod
Replacement**

The GAP-2 pod and the optional IPM module can be replaced while the Narkomed 6400 system is operating. The system will be fully functional within 60 seconds after the module is installed without any further intervention by the clinician. For GAP-2 replacement instructions, see Section 10 of this manual. For IPM module replacement instructions, see the *Integrated Patient Monitor Option Operator's Manual*.

Breathing System Interface Panel

An interface panel, located on the left side of the Narkomed 6400 below the ventilator, contains the following hoses and connections:

- fresh gas outlet hose
- oxygen sensor
- flow sensor (respiratory volume sensor)
- breathing pressure pilot line.

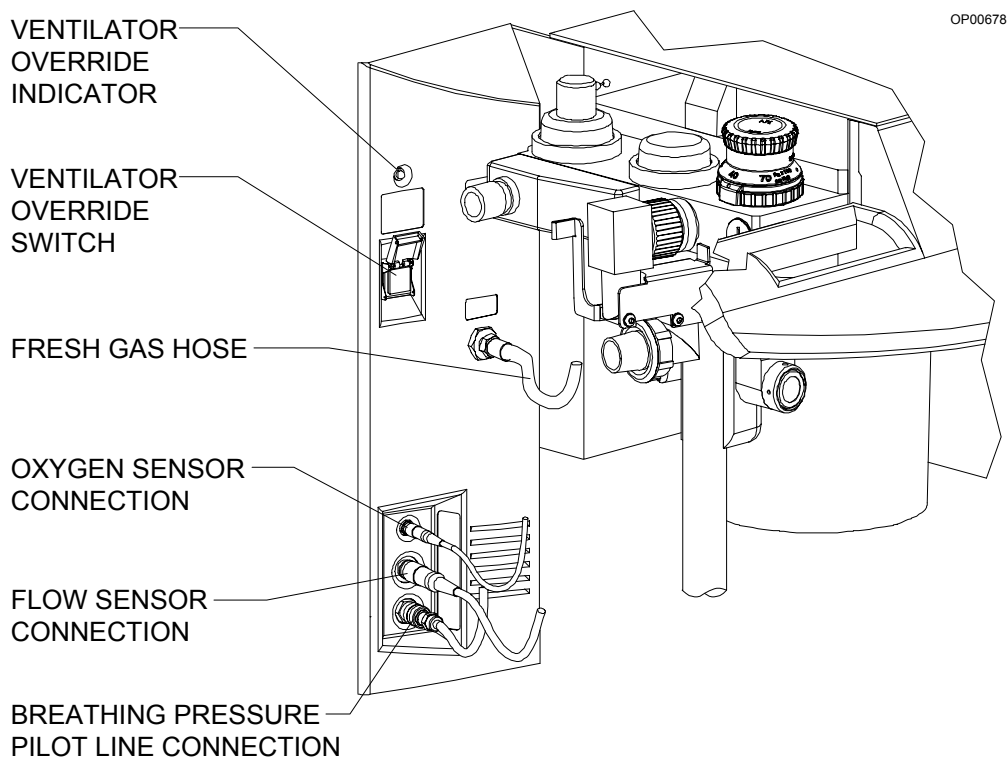


Figure 2-40. Breathing System Interface Panel

Communications Interface Panel

The communications interface panel is located on the back of the machine, below the pipeline inlets. It contains six Vitalbus ports used to interconnect various Narkomed 6400 subsystems and one RS-232 Vitalink port used to export data to an external device.

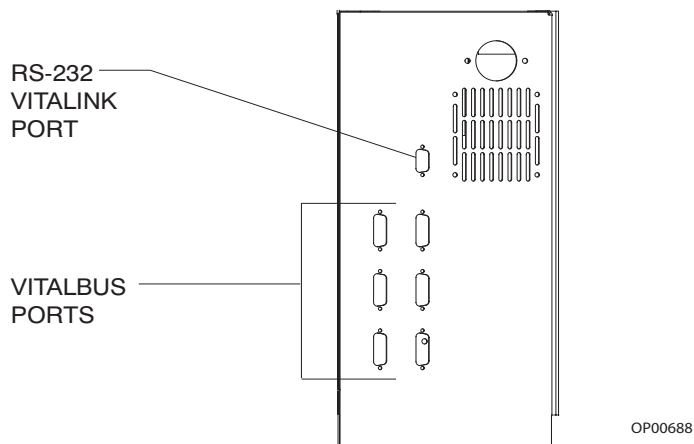


Figure 2-41. Communications Interface Panel (Standard Configuration)

Advanced Communications Option

The advanced communications option is available to allow the Narkomed 6400 to communicate with multiple external devices. It provides a parallel printer port and a total of three Vitalink ports, as well as the standard six Vitalbus ports.

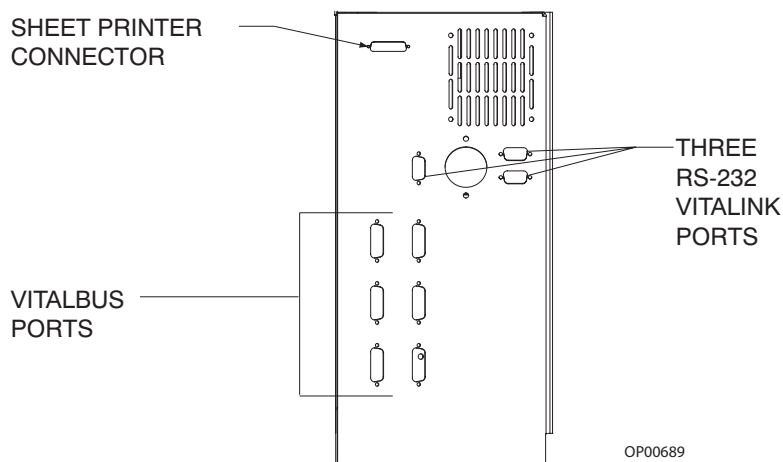


Figure 2-42. Advanced Communications Option

Sheet Printer Interface Option

The sheet printer interface allows the clinician to print selected data log information to an external sheet printer. The printer connects to a parallel port located on the rear of the anesthesia machine as shown in Figure 2-43.

Print functions are controlled using the control buttons in the print notebook. See “Printing Patient Data” on page 3-47 for more information. For a list of commercially available compatible printer drivers and printers, see page A-1-19.

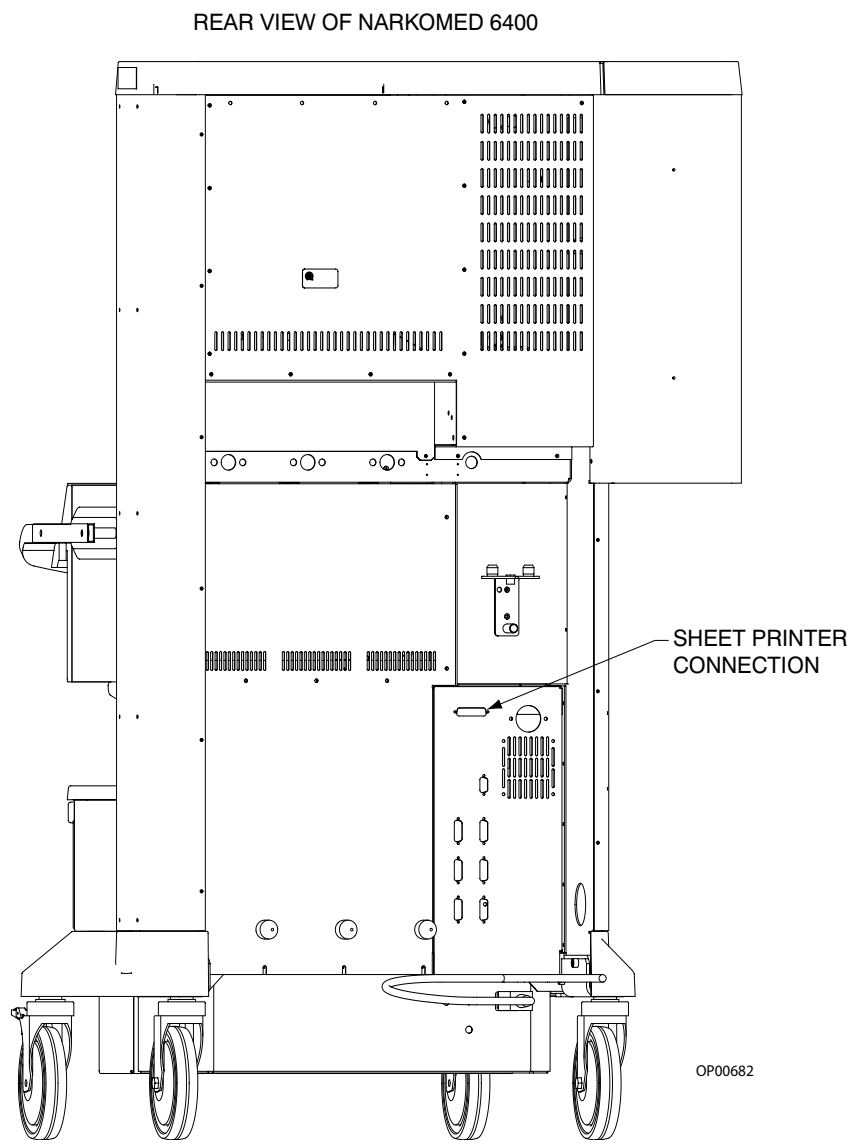


Figure 2-43. Sheet Printer Interface Connection

Strip Chart Recorder (SCR) (CUSTOMER OPTION)

The strip chart recorder is used to print selected waveform, vital sign, and data log information.

Printing functions are controlled using the four keys on the front panel of the strip chart recorder and the control buttons in the print notebook. The functions of the four keys on the strip chart recorder are described below. For information on the print notebook, see “Printing Patient Data” on page 3-47.

**RECORD
WAVE**

Pressing the **[RECORD WAVE]** key initiates continuous waveform printing based on configuration settings selected in the Print notebook.

**PRINT
DATA LOG**

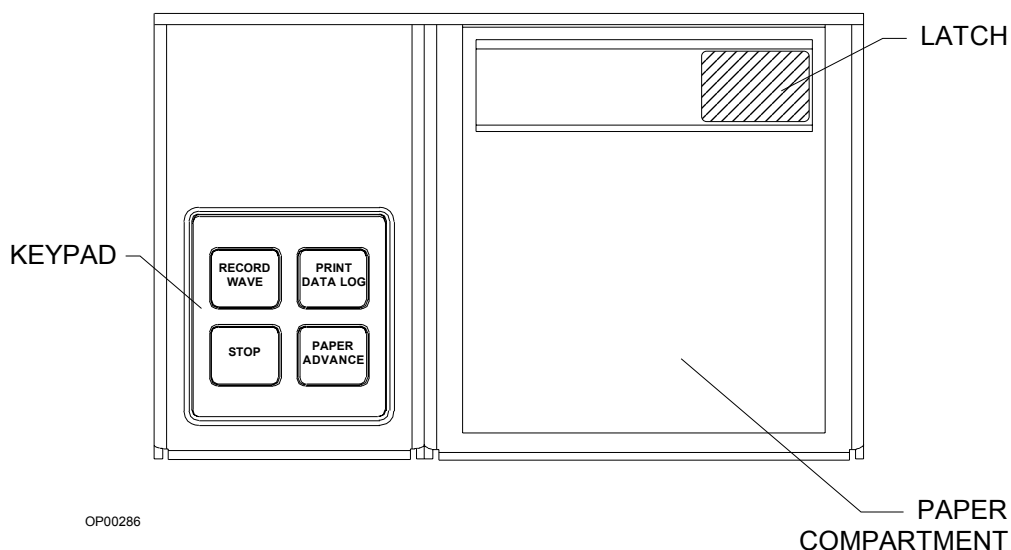
Pressing the **[PRINT DATA LOG]** key prints the contents of the Data Log.

STOP

Pressing the **[STOP]** key stops the current print process.

**PAPER
ADVANCE**

Pressing the **[PAPER ADVANCE]** key advances the recorder paper as long as the key is pressed.



Surgeon Display Controller (CUSTOMER OPTION)

The surgeon display controller allows the use of an additional, configurable display that can be placed on top of the Narkomed 6400 or mounted in a remote location. Likewise, the controller can be mounted to the side of the anesthesia machine or in a remote location. The controller is connected via a serial data cable to a Vitalink port located on the back of the anesthesia machine. A video cable connects the controller to the display.

The surgeon's display can show selected waveform and numeric information. The number of waveforms that can be displayed simultaneously depends on the baud rate and the combination of waveforms (see "Allowable Waveform Export Tables" on page A-1-18 for more information).

The display is configured using an adjustment knob on the controller or an optional, tethered remote control. For complete operating instructions, see the *Surgeon Display Controller for the Narkomed 6400 Operator's Manual*.

Auxiliary Video Output (CUSTOMER OPTION)

The auxiliary video output option allows the use of an additional display mounted either on top of the Narkomed 6400 or in other remote locations. The information presented on the auxiliary display is identical to the information on the main Narkomed 6400 screen but has no interactive capability. Up to three displays can be used. Each display requires the use of an isolation transformer.

Warning: Connection of non-medically approved displays requires use of a medically certified isolation transformer on the display power input to prevent Narkomed 6400 leakage currents from exceeding limits.

The auxiliary display is connected via video cable to one of the three video connectors located on the back of the anesthesia machine. A power cord connects the auxiliary display to the isolation transformer. A separate power cord is used to connect the isolation transformer to AC power.

Warning: Do not plug the isolation transformer AC power cord into the convenience outlet on the Narkomed 6400.

Any purchased display must meet the specifications provided in the *Specification for Flat Panel Display for Auxiliary Video Output*, part number 4117821. Contact Draeger Medical for complete information.

Patient Suction System

Warning: Do not apply unregulated suction to the patient circuit when using this device.

Connections and Switch

Standard Diameter-Indexed Safety System (DISS) vacuum fittings are provided on the rear and left side of the Narkomed 6400, for mounting and connecting a patient suction system.

A toggle switch is provided on the front of the Narkomed 6400 to turn patient suction on and off. When this switch is **ON**, the vacuum source is connected to the vacuum regulator and bottle. When the switch is **OFF**, then no vacuum is connected to the vacuum regulator and bottle.

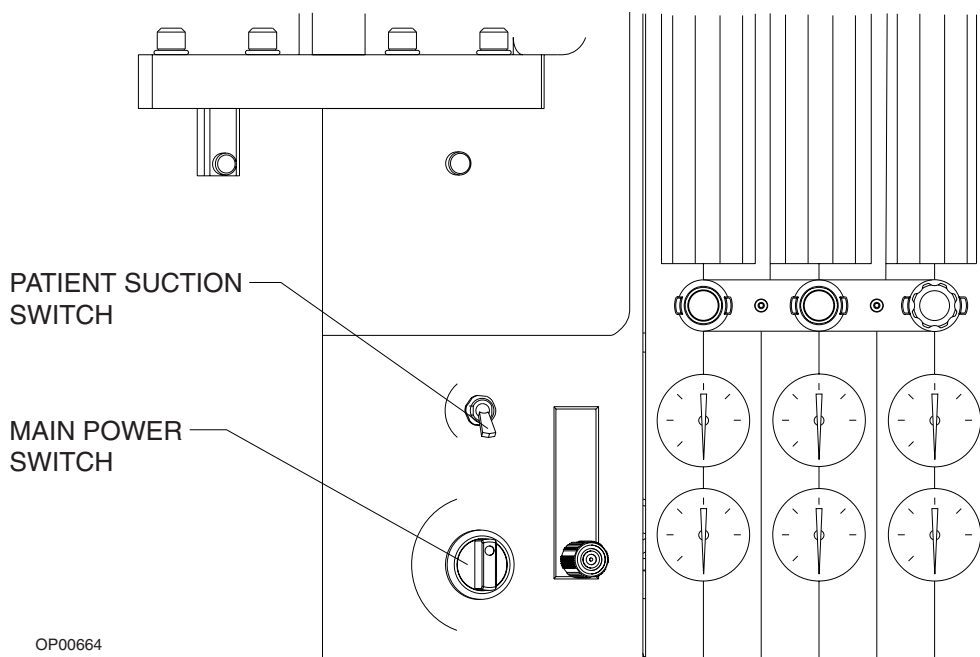


Figure 2-44. Patient Suction Switch

Patient Suction System (CUSTOMER OPTION)

The suction system option on the Narkomed 6400 is designed for aspirating mucus, blood, and other patient drainage fluids. It consists of a fluid collection receptacle and a suction regulator that attaches to the vacuum DISS connector on the side of the Narkomed 6400.

The fluid collection receptacle may be one of two types: disposable plastic canister or reusable glass canister. Collecting patient fluids locally keeps them out of the piped vacuum system. The suction regulator consists of a body with an integral on/off valve, gauge, diaphragm assembly, and inlet/outlet fittings. The regulating mechanism is the diaphragm assembly which controls the amount of suction pressure.

Note: A universal suction bottle mounting bracket is provided for a user-supplied suction bottle.

Note: A local switch on the regulator must be **ON** for the receptacle to be filled when the Narkomed 6400 suction switch is in the **ON** position.

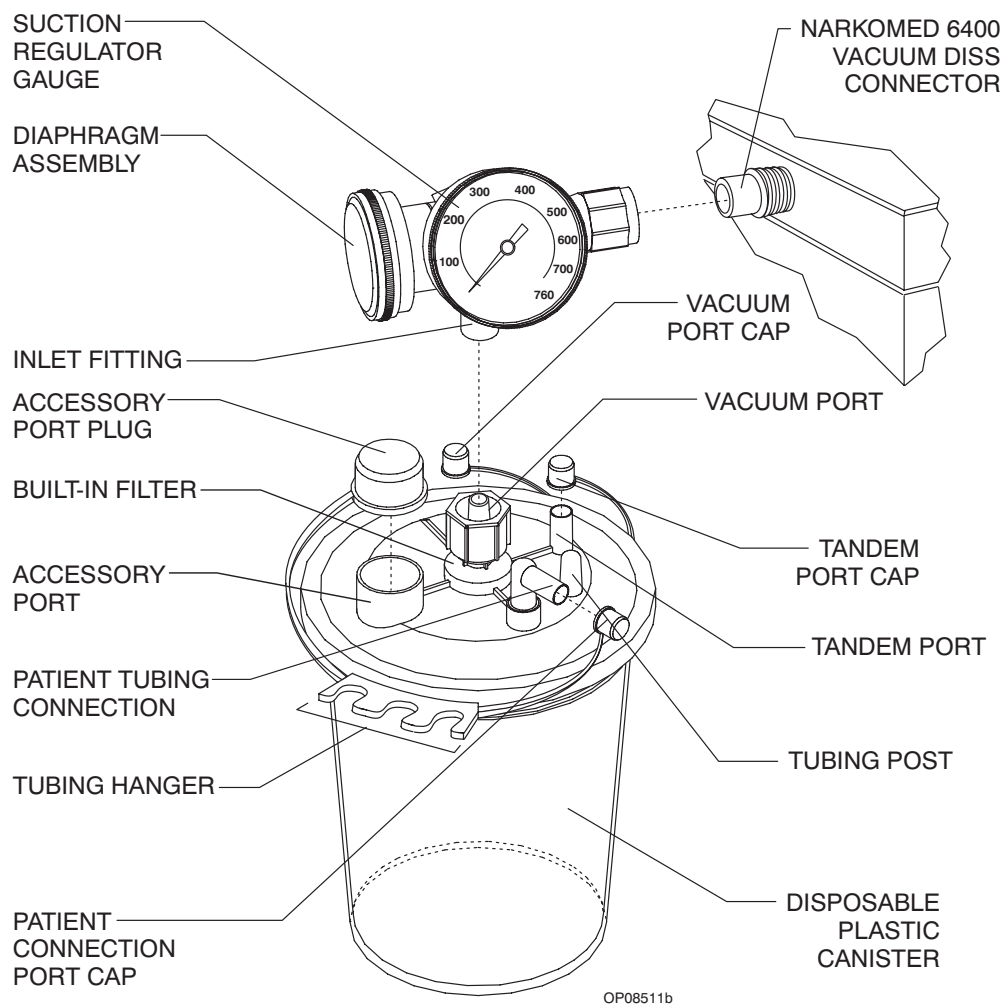


Figure 2-45. Patient Suction System

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[RETURN TO CD-ROM TABLE OF CONTENTS](#)

3

System Configuration

The Narkomed 6400 monitoring system can be configured to meet the specific needs of an individual clinician or hospital. This section begins with initial warm-up of the Narkomed 6400. Following subsections describe system-wide adjustments to main screen displays and alarms.

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Initial Warm-up

When the Narkomed 6400 is turned **ON** at the power switch on the front panel below the vaporizer mounts, a number of actions occur automatically. The monitor displays a start-up screen; the processor begins a checkout of all the component systems; and the ventilator warms up and begins its self-test cycle.

Start-up Screen

During start-up electrical power is supplied to all component operating systems, as well as pneumatic power to the ventilator.

A cold start-up (i.e. the system power switch has been set to **STANDBY** for more than four minutes) initiates extensive self-diagnostics on internal hardware, requiring approximately five minutes if the full ventilator self-test is executed.

Note: With a warm start-up, where the machine is shut down and then powered up again within four minutes, the ventilator skips some of the self-tests.

Note: Diagnostics without the ventilator self-test require about a minute.

Operating the Narkomed 6400 under normal circumstances assumes fully functional gas analysis pod and volume, pressure, and oxygen (VPO) monitor and a fully responsive, real-time monitoring screen. During the diagnostics, each test and its result (**Pass** or **Fail**) appear on the main screen, showing the status of various components of the system. A complete table of self-diagnostic tests is provided in “Self-Diagnostic Tests” on page A-1-2.

An initialization screen appears on the system monitor within 10 seconds. At the end of the self-diagnostic tests, the Narkomed 6400's status is posted in the lower right screen. The monitor displays the results of diagnostic tests for each component subsystem.

If the Periodic Manufacturer's Certification (PMC) due date has passed, then at the end of diagnostics a Periodic Manufacturer's Certification Due message will be displayed.

System Functional

The notation **SYSTEM FUNCTIONAL** appears in the lower right initialization screen when every tested component of the machine is in satisfactory operational order. To continue immediately, the clinician presses **[Continue]**. Otherwise, the **SYSTEM FUNCTIONAL** screen remains on the monitor for about five seconds, after which the main screen monitoring displays appear automatically.

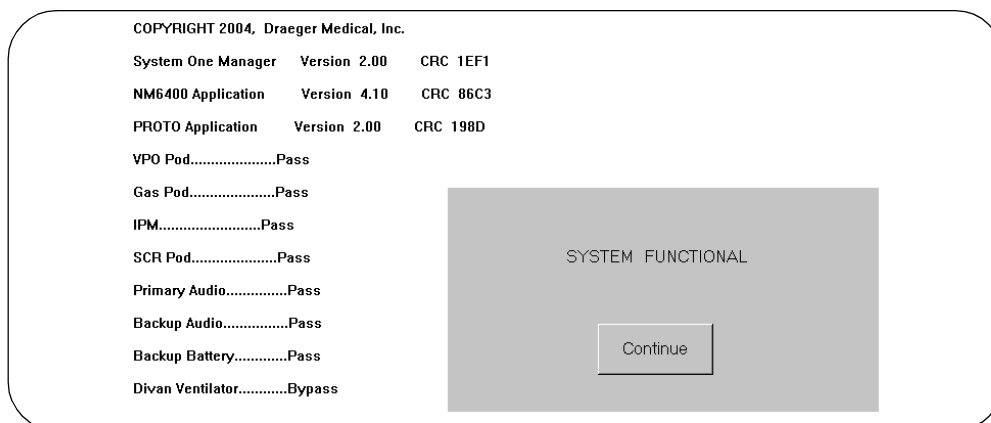


Figure 3-1. SYSTEM FUNCTIONAL Screen

System Conditionally Functional

The notation **SYSTEM CONDITIONALLY FUNCTIONAL** appears in the lower right initialization screen when a nonessential component of the machine is not functioning properly or if PMC is due. The machine can be used, but an authorized representative of DrägerService should be notified to correct the problem. The clinician must acknowledge the indicated failure by pressing **[Continue]**. The Narkomed 6400 will not automatically proceed to the main screen.

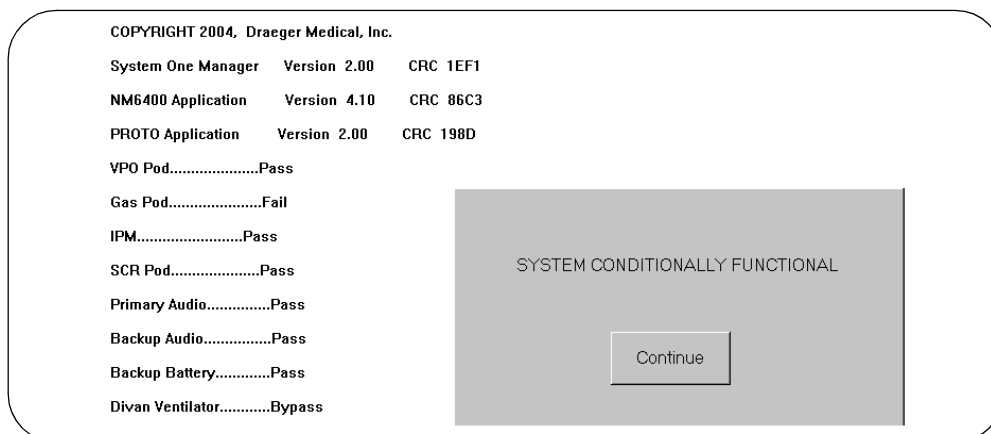


Figure 3-2. SYSTEM CONDITIONALLY FUNCTIONAL Screen

System Non-Functional

The notation **SYSTEM NON-FUNCTIONAL** appears in the lower right initialization screen when an essential component of the machine is malfunctioning. An interlock prevents access to the monitor touch screen. A non-functional system permits power to use the ventilator, and the initialization screen reflects the continued system diagnostics. Do not use the machine. Notify an authorized representative of DrägerService immediately to correct the problem.

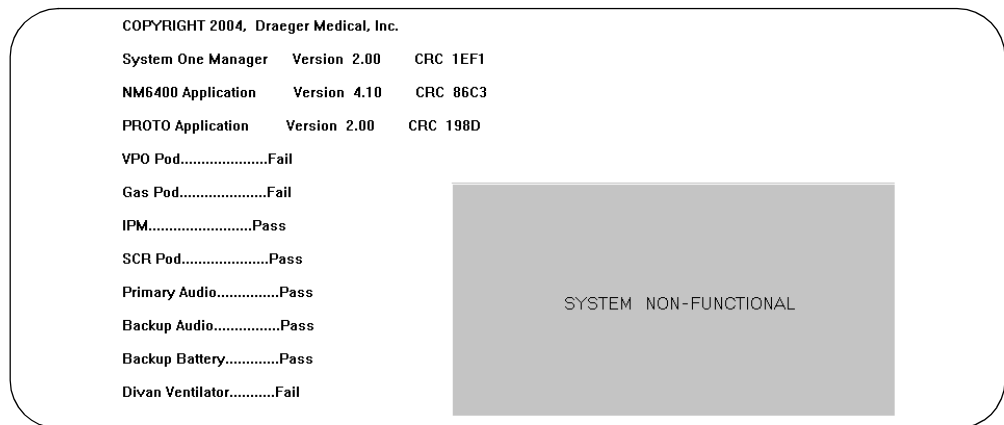


Figure 3-3. **SYSTEM NON-FUNCTIONAL** Screen

Ventilator Self-Test

The ventilator initiates a self-test each time the Narkomed 6400 is powered on. The clinician does not need to take the time for a complete self-test before each case and may place the ventilator in **Ventilator Standby** status after its self-test has begun. However, Draeger Medical recommends performing a self-test daily. The monitor records the date and time that the last valid ventilator self-test was run and registers elapsed time.

If no complete self-test has been conducted after 10 days (240 hours), a **VENT TEST DUE** advisory will be displayed in the alarm window. If this happens during a case, the self-test should be performed at the soonest opportunity after the case is completed.

Furthermore, if the clinician attempts to bypass the ventilator self-test more than 10 consecutive times during the warm-up procedure or after a ventilator equipment fault has been detected, a **COMPLETE TEST** message will be displayed on the ventilator control panel during system diagnostics. If this should occur, clinician must restart the warm-up process and perform the complete self-test in order to complete the diagnostic tests and continue warm-up to access the monitoring screen.

For additional information, see “Ventilator Self-Test” on page 7-5 and “Divan Ventilator Self-Test Flow Chart” on page A-4-1.

Warning: These procedures must not be performed while the ventilator is attached to a patient.

Note: During the ventilator self-test, minimum O₂ fresh gas flow is turned **OFF**.

System Reset and Calibration

Diagnostic tests are the means through which the ventilator recalibrates its controls. It would be unlikely to operate the system continuously, that is, the main power switch never turned from **ON** to **STANDBY**, for days at a time. However, a dialog box would appear that prompts a system reset and requires the clinician’s confirmation to continue.

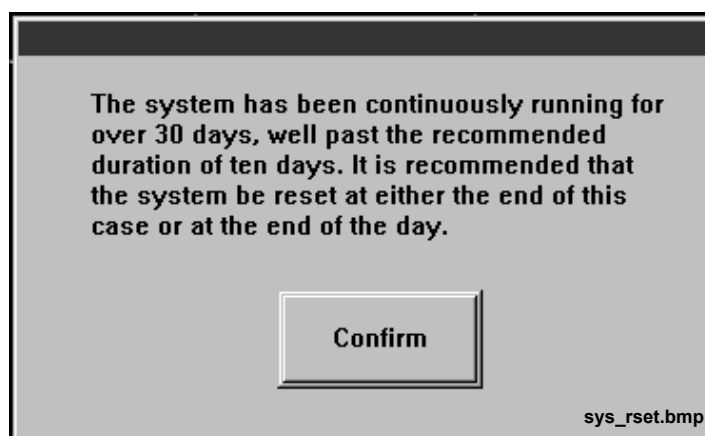


Figure 3-4. System Reset Prompt

Under normal circumstances the clinician would never see this dialog box. The recommended daily checkout procedure includes a power-down, system reset, and ventilator self-test. See “Oxygen Cylinder - High Pressure System” on page 7-3 for the sequence in which the **STANDBY** selection is made.

If the system reset prompt dialog box should appear:

1. Press [**Confirm**] to acknowledge the prompt.
2. Reset and recalibrate the system by turning the main power switch from **ON** to **STANDBY**.

Allow the full diagnostic sequence to cycle. Do not attempt to bypass the ventilator self-test. See “Start-up Screen” on page 2 and “Ventilator Self-Test” on page 4 of this section for a complete description.

3

System Configuration

Automatic Device Compliance Correction

The ventilator automatically corrects for the effect of system compliance in the tidal volume setting. Compliance is established during the self-test or a leak and compliance test. The reduction in tidal volume due to system compliance is then corrected automatically during ventilation so the patient receives the set tidal volume.

Repeat the leak and compliance test whenever any changes are made to the hoses. For complete details, see “Ventilator Leak and Compliance Test” on page 7-19.

Emergency Quick-Start

The emergency quick-start procedure shortens the self-test when the ventilator must be operational immediately. This quick-start procedure can be performed up to 10 times in succession, but only if no fault has occurred since the last successful full self-test.

1. Any time during the ventilator self-test, press and hold down the **[Standby]** button on the ventilator control panel until **_x Cancel Test** appears on the ventilator alphanumeric display, indicating the number of times the self-test has been bypassed since the last complete self-test.

The following dialog box will be displayed if the ventilator self-test has been bypassed eight times and each time thereafter until the test is run. Press **[OK]** to continue.

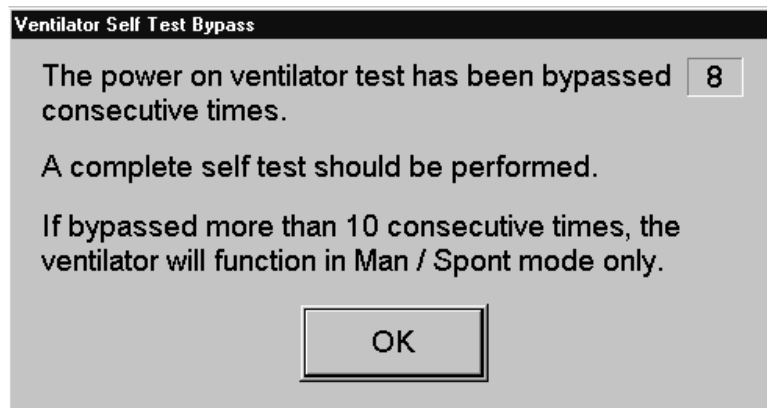


Figure 3-5. Ventilator Self-Test Bypass Dialog Box

2. The ventilator will go into **Ventilator Standby** status after a bypassed self-test.

System Setup

System-wide settings are made in the system setup notebook and with the main control buttons that appear at the bottom of the main screen. They are used to access specific programs for monitoring display configuration, as well as other tasks.

Main Control Buttons

The main control buttons appear at the bottom of the main screen in a taskbar.

Note: The text or appearance of some main control buttons changes after performing an action. The label always reflects the action that will be taken when the button is touched again, not the current status. Control buttons used to display notebooks or data windows change to a darker background color when touched and will remain dark as long as the display is active. Control buttons that perform a momentary function will appear darker for approximately three seconds after being touched to acknowledge the clinician's action.

Monitor
Standby

Pressing the **[Monitor Standby]** button opens a confirmation dialog box, **Enter Monitor Standby**, to confirm **Monitor Standby** status. The NM6400 can only be placed in Monitor Standby when the DIVAN Ventilator is in Standby.

Setup
Notebook

Pressing the **[Setup Notebook]** button displays the system setup notebook for the Narkomed 6400. It is used in configuring the system for individual preferences for a case. See "System Setup Notebook" on page 10 later in this section for details of use.

Press
Gauge

Pressing the **[Press Gauge]** button displays a movable software breathing pressure gauge on the screen. For complete information, see "Software Pressure Gauge" on page 42 later in this section.

Print

Pressing the **[Print]** button displays the print notebook which contains print options for the strip chart recorder and/or external sheet printer. If the machine is not configured with a strip chart recorder or external sheet printer, this button is grayed out on the screen. For complete information, see "Printing Patient Data" on page 47 later in this section.

Trend

Pressing the **[Trend]** button opens and closes the trend window, displayed on the left third of the main screen, which displays graphic trend data recorded in 30-second intervals. If a notebook is open when the **[Trend]** button is pressed, it closes and is cleared from the main screen. See "Trend Window" on page 8-7 for a discussion of automatic data recording during operation of the Narkomed 6400.

Clear Trends

Pressing the **[Clear Trends]** button opens a dialog box with two selections; one cancels the clear trends request, the other clears all recorded case data. Pressing the **[Clear Trends, Data Log, and Alarm Log]** button clears the graphical trend data, the data log, and the alarm log.

Data Log

Pressing the **[Data Log]** button displays a data table on the main screen. Numerical trends are recorded in 1-minute intervals and can be displayed in the data log at 1, 2, 5, or 10-minute intervals. Pressing the **[Data Log]** button again removes it from the main screen. If a notebook is opened during data log display, it is displayed over the data log. Pressing **[Data Log]** to display the data log during a notebook display removes the notebook. See “Data Log” on page 8-13 for a discussion of automatic data recording during operation of the Narkomed 6400.

Auto Pressure Thrshld

Pressing the **[Auto Pressure Thrshld]** button automatically sets the apnea pressure threshold associated with the breathing pressure waveform to 4 cmH₂O less than the currently displayed peak pressure. The automatic setting cannot be lower than 5 or higher than 30 cmH₂O. The default setting is 12 cmH₂O. See “Changing the Apnea Pressure Threshold Limit Line” on page 5-4 for details.

O2 Cal

Pressing the **[O2 Cal]** button opens a confirmation dialog box, **Calibrate O2 Sensor**, to start the oxygen monitoring system calibration procedure. See “Calibrating the Oxygen Monitoring System” on page 5-18 for details. This button is disabled when the oxygen zero calibration values are invalid.

Alarm Suspend

The **[Alarm Suspend]** button suspends some patient monitoring visual and audio alarms. Its label changes to **[Cancel Alarm Suspend]** and the processor posts the advisory message **ALARMS SUSPEND** in the alarm window. Any other advisory messages remain displayed in the alarm window.

Pressing **[Cancel Alarm Suspend]** restores all alarms, removes the message, and reinstates the button label as **[Alarm Suspend]**. There is no change to a notebook display when pressing either button. See “Suspending Alarms” on page 57 in this section for details and “Alarm Management” on page 6 of Appendix 1 for complete tables of **Alarm Suspend** configurations.

Main Screen

Pressing the **[Main Screen]** button removes all notebooks and the data log from the screen for immediate full viewing of the waveforms. This button does not close the trend window.

To Secondary Keys

Pressing the **[To Secondary Keys]** button toggles the taskbar to provide additional main control buttons to be used for a second set of tasks.

Template	Pressing the [Template] button opens the Template page of the System Setup Notebook. For complete information on the use of templates, see “Template” on page 3-19.
Respi- tone®	Pressing the [Respitone] button opens the setup page of the Ventilator Information notebook. For complete information, see “Ventilator Information Notebook” on page 3-30.
Vent Info Notebook	Pressing the secondary taskbar [Vent Info Notebook] button opens and closes the Ventilator Information notebook. For complete information, see “Ventilator Information Notebook” on page 3-30.
Low Flow Wizard	Pressing the [Low Flow Wizard] button opens and closes the Low Flow Wizard window, displayed in the lower right corner of the waveform area. For complete information, see “Low Flow Wizard” on page 3-34.
Limits Autoset	Pressing the secondary taskbar [Limits Autoset] button opens a confirmation dialog box, Perform Limits Autoset , that allows the clinician to autoset all system alarm limits at the same time, as defined in the system setup notebook [Alarms Limits] tab. See “System Alarm Limits” on page 15 in this section for the sequence in which the control is used.
Utilities Notebook	Pressing the secondary taskbar [Utilities Notebook] button provides access to the utilities notebook, which contains a calculator page, a timers page, an alarm log page, a software pressure gauge page, and a fresh gas information page. Each of these pages is described in detail later in this section of the manual, beginning on page 3-36.
To Primary Keys	Pressing the [To Primary Keys] button toggles all control buttons back to their primary function.

Slider Bar

Many notebook pages contain or provide access to a slider bar that allows the clinician to increase or decrease a particular setting, such as alarm volume or an alarm limit. Touching the upward-pointing arrow [▲] increases the setting, and touching [▼] decreases it.

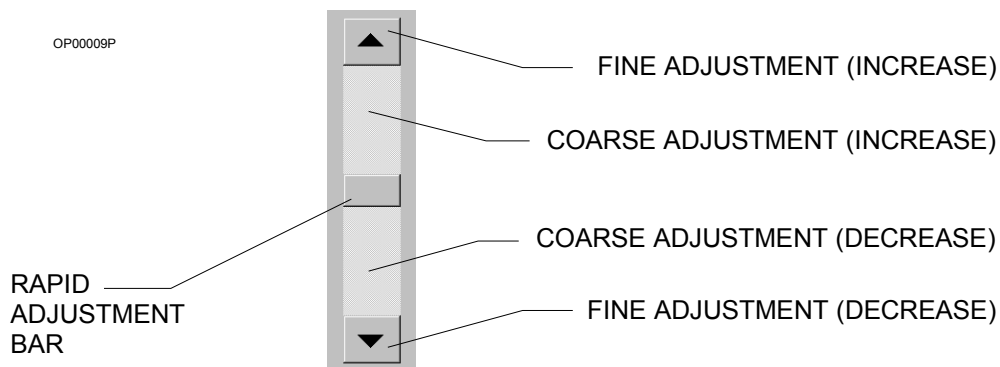


Figure 3-6. Slider Bar Adjustment

There are three ways to use the slider bar:

Type of Adjustment	Action
Fine	Touch the up or down arrow buttons at the top or bottom of the slider to change the value by the smaller amount available for the specific parameter.
Coarse	Touch the area above or below the slider control to change the value by the larger amount available for the specific parameter.
Rapid	Drag (touch and move) the rapid adjustment bar up or down to the preferred position with a fingertip. This method is most effective for making a significant change quickly.

System Setup Notebook

Overall system settings are selected in the system setup notebook. To display the system setup notebook, press **[Setup Notebook]**. If the **[Setup Notebook]** or **[Main Screen]** control buttons or any parameter box is touched when the system setup notebook is open, the notebook closes immediately.

The system setup notebook is the clinician's main interface for configuring the Narkomed 6400 system for routine and custom operation. The notebook allows the clinician to perform the following actions:

- enable/disable the display of units in the parameter boxes
- set the system date and time
- initiate and display the results of a battery test
- initiate a test of the primary and backup speakers

- view and change all parameter alarm limits from one central location
- perform template management
- change waveform trace speeds
- adjust audible alarm volume
- view the versions of currently installed system software

The system setup notebook has six tabs: **[Setup]**, **[Alarm Limits]**, **[Template]**, **[Traces]**, **[Volume]**, and **[About]**.

Colors in the displays are not configurable by the clinician. The parameter color programmed is the same for the label, sublabels, units of measure, alarm limits, numeric value(s), waveform (if it has one), and trend graphic, as follows:

Parameter	Display Color
Pressure	yellow
Volume	blue
Agent/N ₂ O (no agent identified)	peach
- Halothane/N ₂ O	red
- Isoflurane/N ₂ O	purple
- Desflurane/N ₂ O	blue
- Enflurane/N ₂ O	orange
- Sevoflurane/N ₂ O	yellow
CO ₂	white
Oxygen	green

Note: For display colors of parameters monitored by the Integrated Patient Monitor, see the *Operator's Instruction Manual for the Integrated Patient Monitor Option*.

System Setup

Touch the **[Setup]** tab to view the system setup page.

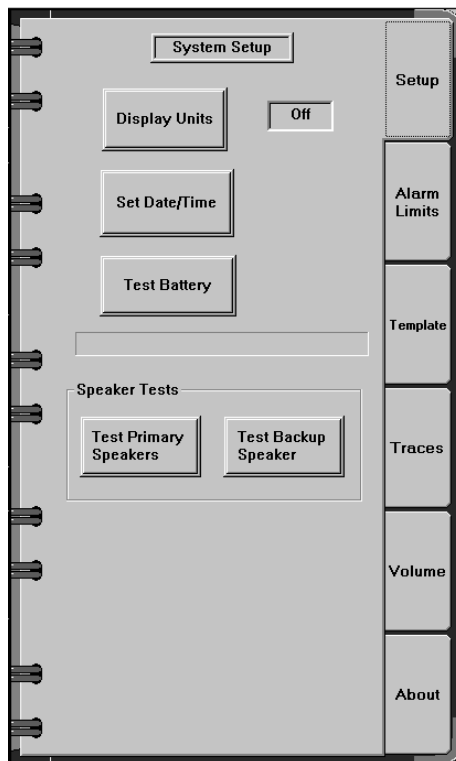


Figure 3-7. System Setup Page

The system setup page contains control buttons that perform the following tasks:

- display units
- set date/time
- test battery
- test primary and backup speakers

Display Units

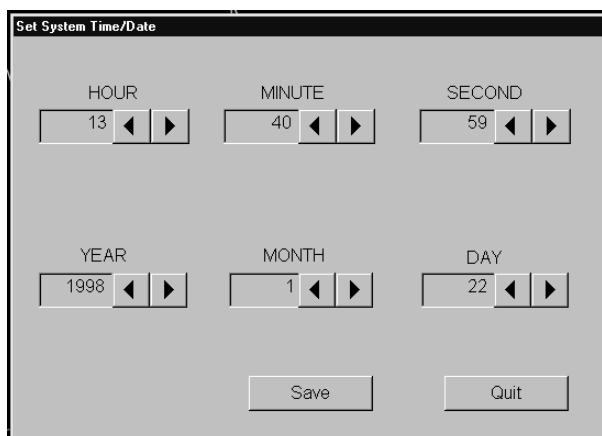
The clinician may display units of measure in all parameter boxes.

Touch **[Display Units]** control button until the preferred setting is displayed.

The associated window switches from **Off** to **On**. The label for appropriate unit of measure, for example cmH₂O, appears in each parameter box. To remove units of measure, touch the control button to toggle from **On** to **Off**.

Set Date/Time The right side of the main screen title bar at the top of the screen shows the current system date and time. The 24-hour format is used for time.

Touch **[Set Date/Time]**. A dialog box is displayed.



time_box.bmp

Figure 3-8. Date/Time Dialog Box

Individual settings for hour, minute, second, year, month, and day appear in individual fields.

To change a setting, touch the arrow next to the field to increase or decrease the value shown. Touching [◀] decreases the value. Touching [▶] increases the value.

To approve the new settings, press **[Save]**. The dialog box clears and the new setting appears in the title bar.

If no changes are needed, press **[Quit]** to cancel changes made (if any) and remove the dialog box from the screen.

Note: Changing the system time during a case (i.e., when data is being recorded) may adversely affect the time displayed in the trend and data log windows.

Battery Test Touch **[Test Battery]** to initiate the system battery test.

The message **Battery Test Requested** is displayed in the window below. Then the results — **Battery Fully Charged** or **Battery Not Fully Charged** — are displayed. The result clears automatically after 60 seconds.

Note: The message window displays results from both the battery test and the speaker tests. If a test is performed while a message is in the message window, the new test results will overwrite the old message.

Note: A battery test is automatically performed during the initial warm-up period when the Narkomed 6400 is first turned on. The start-up screen indicates **In Progress**. The load test is audible when testing takes place in the background during the ventilator self-test.

Speaker Tests

- Touch **[Test Primary Speakers]** to initiate a test of both the left and right speakers. A message — **Speaker Test In Progress**— is displayed in the message window.

If the tests are successful, the alarm advisory tone will sound on both the left and right speakers. A test result message (**Primary Speaker Tests Passed, Left Speaker Test Failed, Right Speaker Test Failed, or Both Speaker Tests Failed**) appears in the message window. The result clears automatically after 60 seconds.

- Touch **[Test Backup Speaker]** to initiate a test of the backup speaker.

If the test is successful, a beep will sound on the backup speaker only. A message — **Backup Speaker Test Passed or Backup Speaker Test Failed** — is displayed in the message window. The result clears automatically after 60 seconds.

Note: The message window displays results from both the battery test and the speaker tests. If a test is performed while a message is in the message window, the new test results will overwrite the old message.

System Alarm Limits

Touch the **[Alarm Limits]** tab to view the system alarm limit setup page. All parameters that have user-controllable alarm limits are accessible from this page for configuration.

Alarm Limit Setup			
Param	High	Low	Autoset
O2	100	18	Narrow
CO2 (E)	50	8	Narrow
CO2 (I)	75	N/A	Narrow
Press	50	N/A	Narrow
Min Vol	N/A	0.2	Narrow
Hal	3.0	0.0	Narrow
Iso	3.0	0.0	Narrow
Enf	3.0	0.0	Narrow
Des	9.0	0.0	Narrow
Sev	6.0	0.0	Narrow

Table 1 of 2

Previous Table Next Table Autoset Single Param

Figure 3-9. Alarm Limit Setup Page

The alarm limit setup page lists each parameter with configurable alarm limits.

To view alarm limits for parameters that are not currently displayed on the screen, press the **[Next Table]** or **[Previous Table]** buttons.

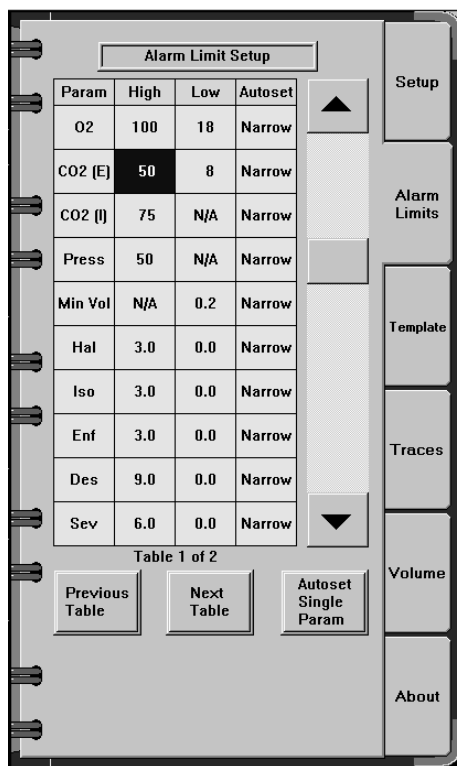


Figure 3-10. Activated Alarm Limit Setup Page

Adjusting High and Low Alarm Limits

To change a parameter **[High]** or **[Low]** alarm limit:

1. Select the desired alarm limit.

The slider bar is activated on the touch screen.

2. Adjust the alarm limit using the fine, coarse, or rapid adjustment controls. The values obtained depend upon the specific parameter.

Parameter	Coarse Adjustment	Fine Adjustment
O ₂	± 10%	± 1%
CO ₂ [E]	± 1%	± 0.1%
CO ₂ [I]	± 1%	± 0.1%
Press	± 10 cmH ₂ O	± 1 cmH ₂ O
PEEP	± 2 cmH ₂ O	± 1 cmH ₂ O
Min Vol	± 1 liter	± 0.1 liter
Hal, Iso, Enf, Des, or Sev	± 1%	± 0.1%

This page may also be displayed during a case by touching any user-adjustable active alarm. The selected alarm limit will be highlighted, and the clinician may adjust the alarm limit as described above.

System-Wide Limits Autoset Control

The clinician can adjust autoset limits for all measured parameters at the same time. The ranges for control are the same as those available for specific autoset limits in individual parameter notebooks, described in Sections 4 and 5.

Autoset Range	Action
Narrow	programs alarm limit to a value different from current value by a narrow margin, not to exceed a specified value
Wide	programs alarm limit to a value different from current value by a wider margin, not to exceed a specified value
Off	no autoset control of alarms for that parameter; [Autoset Single Param] button is not activated (it is grayed out)

1. Touch the **[Autoset]** column to select the desired alarm limit. Continue touching to cycle through the selections available, **Narrow**, **Wide**, or **Off**.
2. Repeat for each desired parameter.
3. Press the **[To Secondary Keys]** control button.

The monitoring system replaces the taskbar at the bottom of the main screen with the additional control buttons.

4. Press the **[Limits Autoset]** control button to adjust all limits using the selected choices. A confirmation dialog box is displayed:

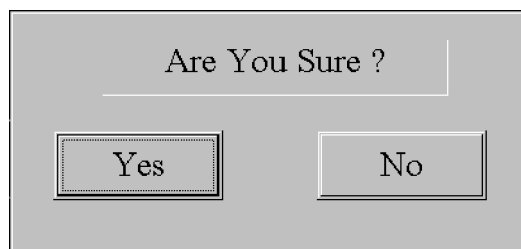


Figure 3-11. Limits Autoset Confirmation Dialog Box

- Touch **[No]** to clear the dialog box from the screen without adjusting the limits.
- Touch **[Yes]** to adjust the limits.

All parameter alarm limits are now adjusted, based on the autoset selections made on the Alarm Limits Setup page. The alarm limits for every enabled parameter will be automatically adjusted to the wide or narrow level around the current value. Numbers in the appropriate parameter boxes change to reflect the new settings.

Autoset
Specific Alarm
Limits

1. Touch the single alarm limit parameter to be changed to autoset.
2. Continue touching until **Narrow** or **Wide** appears in the window, as appropriate.
3. Press the **[Autoset Single Param]** button.

Note: The **[Autoset Single Param]** button cannot be activated (words change from gray to black) until one specific parameter is selected by touching. When the parameter alarm autoset has been set to **Off**, the **[Autoset Single Param]** button is grayed out.

Template

Touch the **[Template]** tab to view the template page.

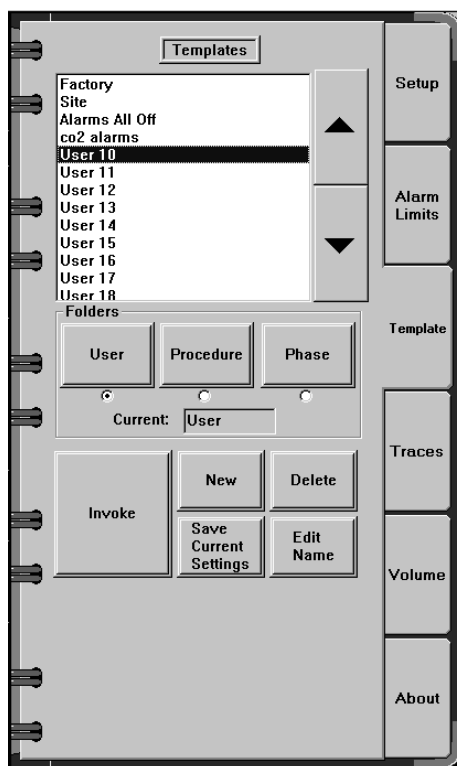


Figure 3-12. Template Page

The Template page allows the clinician to choose preconfigured system settings from a list of previously configured templates. It is also used to change existing templates, create new templates, and delete old ones. For a list of settings that can be stored in a template, see the tables provided in “Factory Default Settings” on page A-1-3.

The top portion of the template page shows the list of templates stored in the currently selected folder. The up and down arrows are used to scroll through the list.

The middle of the template page contains the control buttons used to access the three folders where all templates are stored: **[User]**, **[Procedure]**, and **[Phase]**. The currently selected folder is indicated by the round button beneath the folder control button and is also spelled out in the field labeled **Current**. The User folder contains a Factory template and a Site template. The Factory template contains factory default settings and cannot be modified (the settings in the Factory Template are provided in “Factory Default Settings” on page A-1-3). The Site template contains the settings that are used as the power-on defaults. The clinician can change the Site template settings but cannot change the template name. Each folder can hold a maximum of 100 templates.

The bottom of the template page contains the control buttons used to perform template operations: **[Invoke]**, **[New]**, **[Delete]**, **[Save Current Settings]**, and **[Edit Name]**. Some operations may be unavailable for certain types of templates, and in those instances the control button(s) will be disabled.

Invoke

The **[Invoke]** control button is used to activate a template selected by the clinician.

To invoke a template:

1. Touch the control button of the folder containing the desired template. The template list is updated to show the contents of the selected folder.
2. In the template list window, find the desired template, using the up and down arrow keys if needed. Touch the desired template name.
3. Touch **[Invoke]**. All template-controlled settings are updated according to the selected template, and the name of the selected folder/template is displayed in the title bar.

New

The **[New]** control button is used to create new templates. This button is disabled if the selected folder already contains 100 templates.

To create a new template:

1. Touch the control button of the folder where the new template is to be stored.
2. Touch **[New]**. The New Template dialog box is displayed:

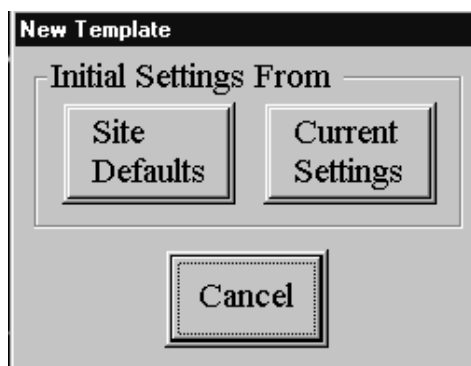


Figure 3-13. New Template Dialog Box

- To create a template based on the existing Site template, touch the **[Site Defaults]** button
 - To create a template based on the current machine settings, touch the **[Current Settings]** button
 - To clear the dialog box from the screen without creating a new template, touch **[Cancel]**
3. If the clinician selects either **[Site Defaults]** or **[Current Settings]**, and those settings have the Full CO₂ alarm control enabled, a confirmation dialog box is displayed (Figure 3-14), followed by a keyboard to allow the clinician to enter a template name (Figure 3-15). If Limited CO₂ alarm control is enabled, the clinician is presented directly with the keyboard (Figure 3-15).

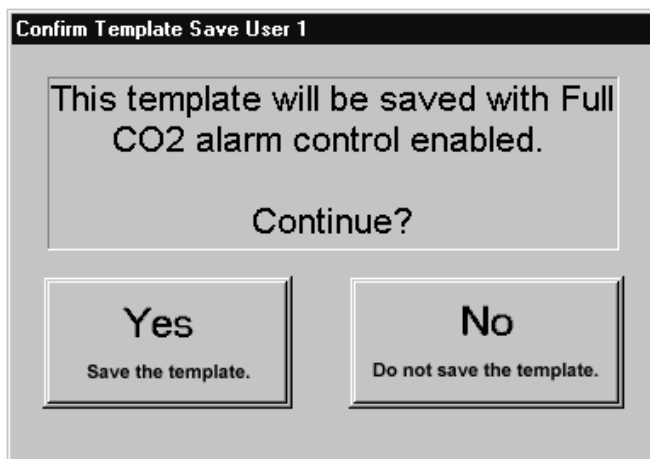


Figure 3-14. Save Template Confirmation Dialog Box (Full CO₂ Control Mode)

- Touch **[No]** to remove the dialog box from the screen without saving the settings
- Touch **[Yes]** to continue; the keyboard window will be displayed to allow the clinician to enter a template name

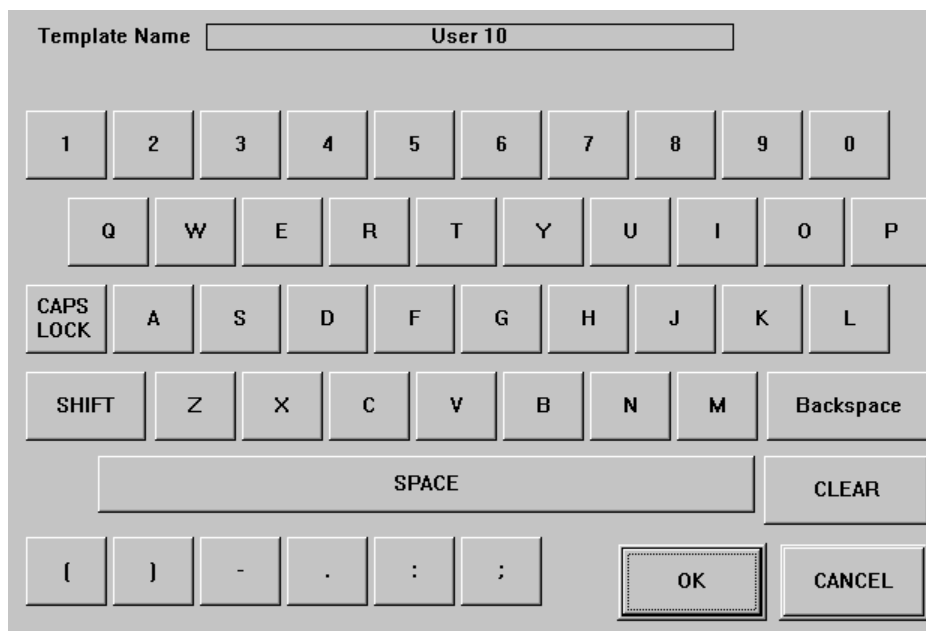


Figure 3-15. Keyboard Window

4. To enter the template name, touch the appropriate letters, numbers, or any of the characters displayed on the screen (including the space). As each key is touched, the character appears in the Template Name field at the top. The template name must be unique and cannot be a duplicate of any other name in any other template folder.

Note: A template name that is the same as an existing template name in all attributes except case (i.e., one name is lowercase and the other is uppercase) is considered a duplicate and will not be accepted.

- Use the **[CAPS LOCK]** control button to toggle between uppercase and lowercase
 - Use the **[Backspace]** and **[Clear]** control buttons to correct mistakes
 - Use the **[Cancel]** control button to remove the keyboard window from the screen without creating a template
5. Continue entering characters to complete the name. When finished, touch the **[OK]** control button. If the name is valid, the template is saved and is added to the list in the template list window.

If the name is a duplicate of any currently existing template in any folder, the template is not be created and a hint message is displayed instructing the clinician to select a unique file name. The clinician will then have to repeat the process.

Delete

The **[Delete]** control button is used to delete templates selected by the clinician. This control is disabled when the Factory or Site template is selected.

To delete a template:

1. Touch the control button of the folder containing the template to be deleted. The template list is updated to show the contents of the selected folder.
2. In the template list window, find the desired template, using the up and down arrow keys if needed. Touch the name of the template to be deleted.
3. Touch **[Delete]**. A confirmation dialog is displayed:

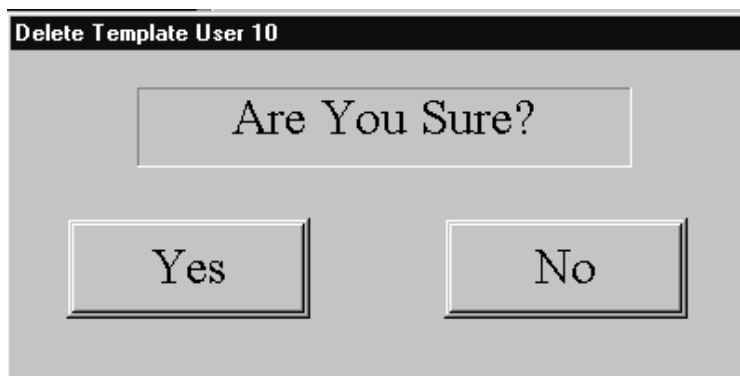


Figure 3-16. Delete Template Confirmation Dialog Box

- Touch **[No]** to remove the dialog box from the screen without deleting the template
- Touch **[Yes]** to continue; the template is deleted and its name is removed from the template list window

Save Current Settings

The **[Save Current Settings]** control button is used to save the current machine settings to an existing template selected by the clinician.

To save the current settings:

1. Touch the control button of the folder containing the template in which the current settings are to be saved. The template list is updated to show the contents of the selected folder.
2. In the template list window, find the desired template, using the up and down arrow keys if needed. Touch the name of the template where the current settings are to be saved.

3. Touch **[Save Current Settings]**. One of two confirmation dialog boxes is displayed. If the current settings have Limited CO₂ alarm control enabled, the dialog box shown in Figure 3-17 is displayed. If the current settings have the Full CO₂ alarm control enabled, the dialog box shown in Figure 3-18 is displayed.

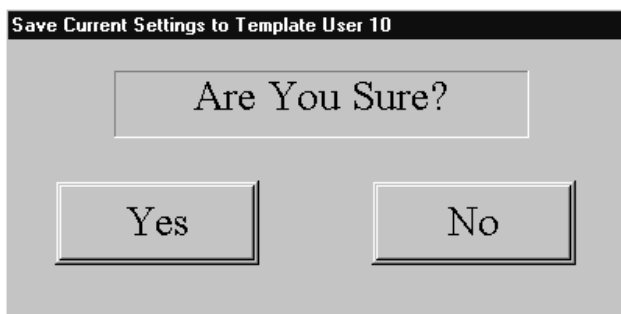


Figure 3-17. Save Current Settings Confirmation Dialog Box (Limited CO₂ Control Mode)

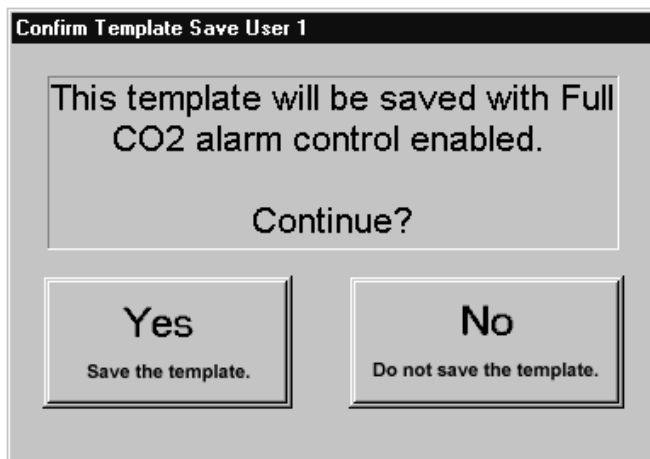


Figure 3-18. Save Current Settings Confirmation Dialog Box (Full CO₂ Control Mode)

- Touch **[No]** to remove the dialog box from the screen without saving the settings
- Touch **[Yes]** to continue; the current settings are saved to the selected template, replacing the previous contents

Edit Name

The **[Edit Name]** control button is used to change the name of an existing template selected by the clinician. This control is disabled when the Factory or Site template is selected.

To edit the name of a template:

1. Touch the control button of the folder containing the desired template.
The template list is updated to show the contents of the selected folder.
2. In the template list window, find the desired template, using the up and down arrow keys if needed. Touch the desired template name.
3. Touch **[Edit Name]**. A keyboard is displayed on the touch screen to allow the clinician to enter the new template name:

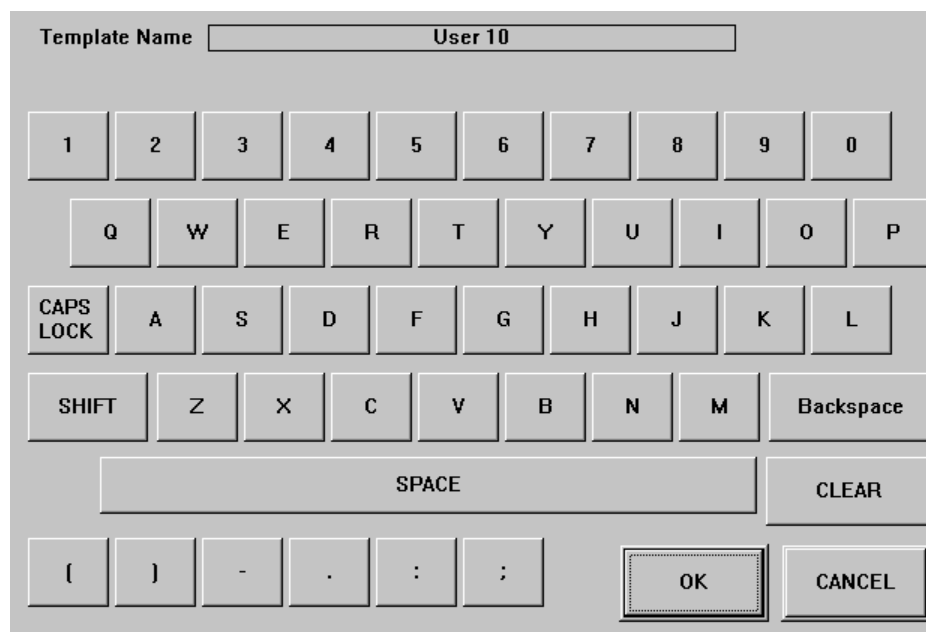


Figure 3-19. Keyboard Window

4. To enter the template name, touch the appropriate letters, numbers, or any of the characters displayed on the screen (including the space). As each key is touched, the character appears in the Template Name field at the top. The template name must be unique and cannot be a duplicate of any other name in any other template folder.

Note: A template name that is the same as an existing template name in all attributes except case (i.e., one name is lowercase and the other is uppercase) is considered a duplicate and will not be accepted.

- Use the **[CAPS LOCK]** control button to toggle between uppercase and lowercase

- Use the **[Backspace]** and **[Clear]** control buttons to correct mistakes
 - Use the **[Cancel]** control button to remove the keyboard window from the screen without creating a template
5. Continue entering characters to complete the name. When finished, touch the **[OK]** control button. If the name is valid, the template name is changed and is updated in the template list window.

If the name is a duplicate of any currently existing template in any folder, the template is not be created and a hint message is displayed instructing the clinician to select a unique file name. The clinician will then have to repeat the process.

Traces

Touch the **[Traces]** tab to view the system traces page.

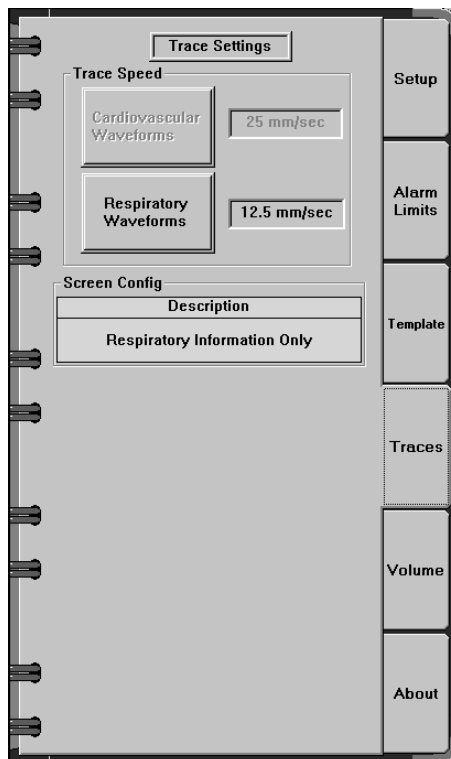


Figure 3-20. System Setup Traces Page (without IPM)

The Traces page contains a button allowing the clinician to select the trace speed for cardiovascular and respiratory waveforms. Touching the **[Respiratory Waveforms]** button toggles the trace speed between 12.5 mm/sec (default) and 25 mm/sec. All waveforms have the same trace speed.

The **[Cardiovascular Waveforms]** button and the Screen Config window are enabled only if the Narkomed 6400 is configured with the Integrated Patient Monitor (IPM). For complete information, see the *Operator's Manual for the Integrated Patient Monitor Option*.

System Alarm Volume

Touch the **[Volume]** tab to view the system alarm volume page.

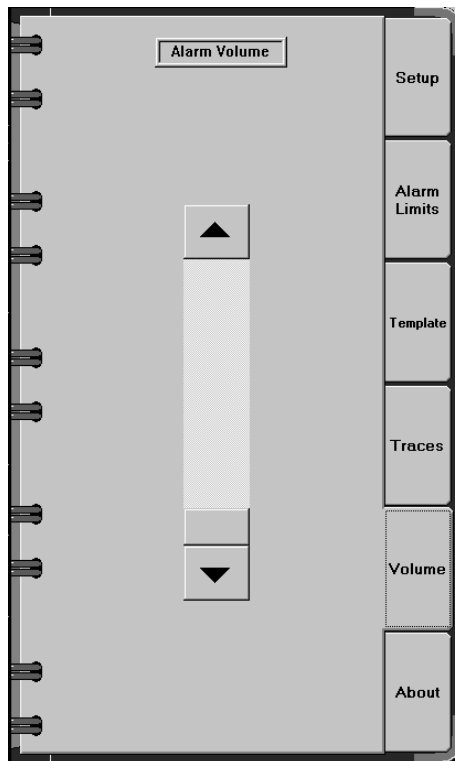


Figure 3-21. System Setup Alarm Volume Page

The alarm volume page contains a slider bar that controls volume of audible alarms, the audio tone in the pressure gauge, and the audio notification in the countdown timer. Although the volume can be turned down, the audible alarms cannot be turned off.

To change the alarm volume for all alarms, use the fine adjust, coarse adjust, or rapid adjustment bar.

The monitor produces a representative tone to assist in selecting the proper level.

About System

Touch the **[About]** tab to view the Narkomed 6400 system software page.

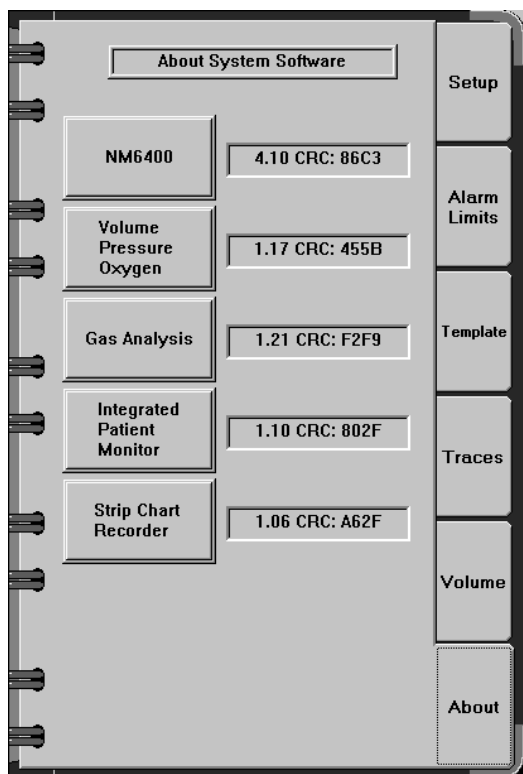


Figure 3-22. About Narkomed 6400 System Software Page

The about page contains information about the specific hardware installed and the corresponding software version, including the version number. This information may be useful when contacting Draeger Medical to request additional information.

Ventilator Information Notebook

The ventilator information notebook displays information about the Divan ventilator and allows the clinician to enable/disable the ventilator confirmation tone and to configure the Respitone ventilation sound.

The notebook has four currently active tabs: **[Setup]**, **[Leak & Compl]**, **[Respitone]**, and **[Help]**.

To access the ventilation information notebook:

1. Press **[To Secondary Keys]** on the main screen taskbar.
Several control buttons change to choose additional tasks.
2. Press **[Vent Info Notebook]** on the new taskbar.

Setup

Touch the **[Setup]** tab to view the ventilator information setup page:

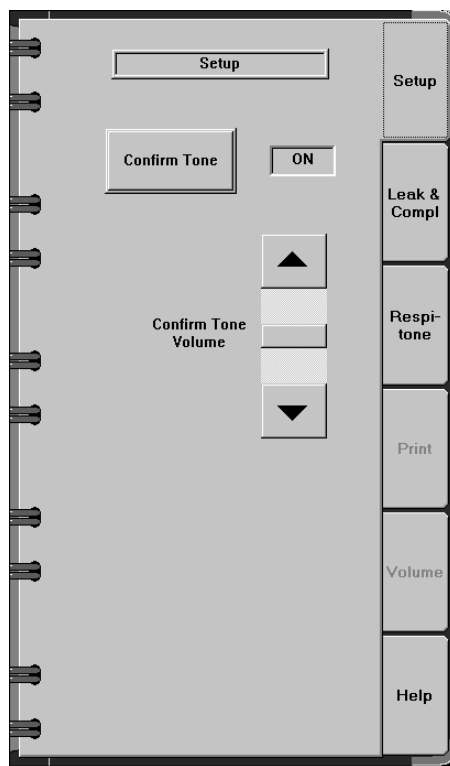


Figure 3-23. Setup Page in Ventilator Information Notebook

Confirm Tone	Touch [Confirm Tone] or its associated selection field to toggle the audible ventilator confirmation tone On or Off .
Confirm Tone Volume	To change the volume of the ventilator confirmation tone, use the fine, coarse, or rapid adjustment on the Confirm Tone Volume slider bar.

Leak and Compliance

To display the leak and compliance page, touch the **[Leak & Compl]** tab in the ventilator information notebook.

The leak and compliance page contains the latest leak test results with a time stamp as well as both measured and used hose compliance values as reported by the Divan ventilator. It also displays a trend of the results from the last 50 leak tests to enable the clinician to spot potential problems.

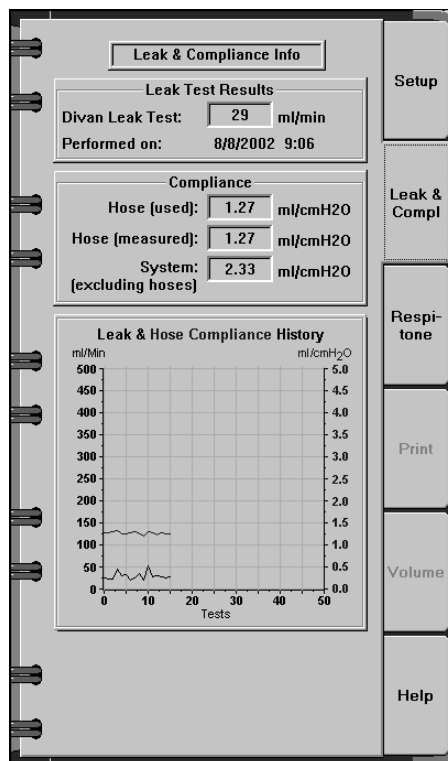


Figure 3-24. Leak and Compliance Page in Ventilator Information Notebook

Respitone

This page lets the clinician configure the Respitone ventilation sound. The sound is composed of two distinct tones. One tone annunciates when the pressure waveform crosses the apnea threshold (corresponding to inhalation), and another tone annunciates on the rising edge of a valid CO₂ breath (corresponding to exhalation).

To display the Respitone page, touch the **[Respitone]** tab in the ventilator information notebook.

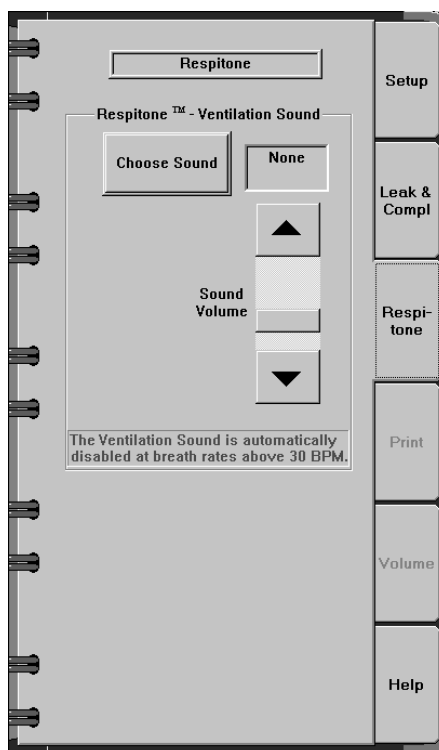


Figure 3-25. Respitone Page in Ventilator Information Notebook

Choose Sound

Touch the **[Choose Sound]** button or its associated selection field to select the preferred Respitone sound. The choices are **Sound 1** through **Sound 7**, and **None**.

Note: Respitone is automatically disabled at breathing rates above 30 BPM.

Note: Sounds 5 through 7 should be used with breathing rates below 14 BPM or the sounds may overlap.

Sound Volume

To change the volume of the Respitone, use the fine, coarse, or rapid adjustment on the **Sound Volume** slider bar.

Help

To display the help page of the ventilator information notebook, touch the **[Help]** tab. This page contains a table with recommended bag sizes based on the selected tidal volume and a table of compliance compensation values used by the Divan ventilator.

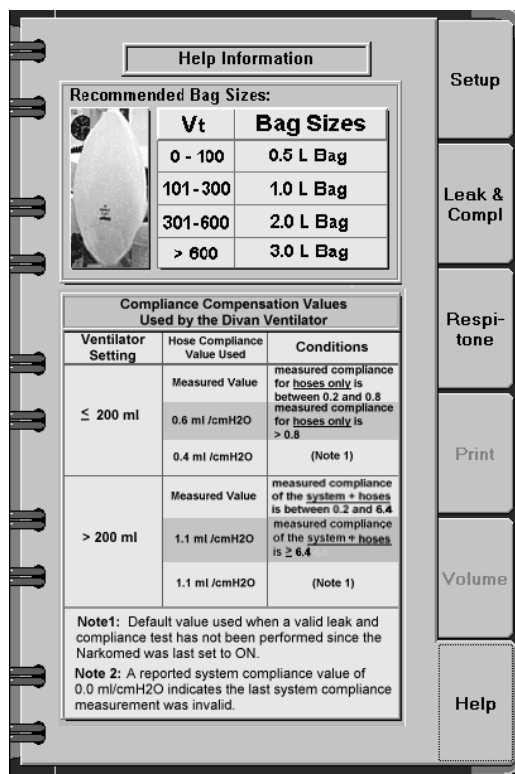


Figure 3-26. Help Page in Ventilator Information Notebook

Low Flow Wizard

Warning: This tool should not be used when higher flows are required such as during induction, emergence, or other times when rapid changes to the concentration of gases in the circuit are desired.

The Low Flow Wizard assists the clinician in assessing the fresh gas surplus during low flow anesthesia cases. It is operational when the Divan ventilator is in any mechanical ventilation mode.

To display the Low Flow Wizard window:

1. Press [**To Secondary Keys**] on the main screen taskbar.
Several control buttons change to choose additional tasks.
2. Press [**Low Flow Wizard**] on the new taskbar. The Low Flow Wizard window appears in the lower right corner of the waveform area (initially), but it can be moved by the clinician to any other part of the waveform area.

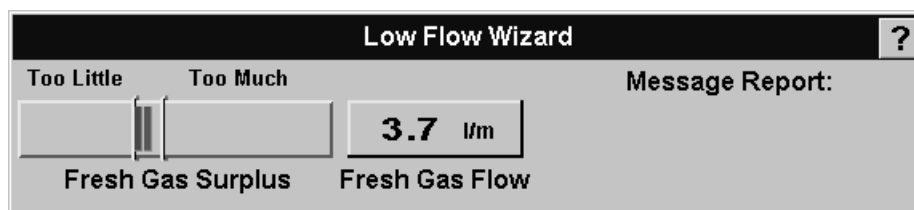


Figure 3-27. Low Flow Wizard Window

The Low Flow Wizard window contains a graphical representation of the fresh gas surplus, a numeric value for total fresh gas flow, a Message Report area, and a help key (“?”). Data in the window is updated at least once per breath or whenever the Divan ventilator mode changes.

Bar Graph Scale

The bar graph indicates the amount of fresh gas surplus, ranging from Too Little to Too Much. A trend arrow next to the bar graph indicates the surplus tendency; a right arrow indicates an increase, and a left arrow indicates a decrease. In case of a persistent equilibrium condition, the arrow is removed.

Data is removed when the Divan ventilator is set to either **Manual/Spontaneous** or **Standby**, or when any condition occurs where the wizard is not able to accurately assess the fresh gas surplus. A message appears in the Message Report area when data cannot be displayed (see “Message Report Area” below).

Fresh Gas Flow

The numeric value shown in the Low Flow Wizard window is the total fresh gas flow in liters per minute as measured by the Narkomed 6400 electronic fresh gas flow measurement system. This value will be blank (grayed out) when there is an error in the electronic measurement of all three gases or when the measured flow for any single gas is >12 L/min. For complete information on total fresh gas flow, see “Fresh Gas Information” on page 3-45.

Message Report Area

The Message Report area is used to display information associated with low flow ventilation. It displays a recommended bag size any time that the tidal volume setting on the Divan ventilator changes. It also posts an explanatory message whenever data cannot be displayed. The possible messages are listed in the table below.

Low Flow Wizard Messages
Recommend xxx liter bag (where xxx is 0.5, 1.0, 2.0, or 3.0)
Fresh Gas Too Low
Divan Settings out of range
Breath Rate Too High
Not Active at This I:E Setting (ratio outside the range of 1:3.0–2.0:1)
Not active in Man/Spont mode
Not active in Standby Mode
Temporarily Disabled
Ventilator Comm Error

Help Key

Pressing the “?” key in the title bar of the Low Flow Wizard window displays the following message:

Fresh gas surplus indicates the potential for wasted gases and agents by measuring scavenger flow. This tool should not be used when higher flows are required for making rapid changes to the concentration of gases in the circuit.

WIZARD INDICATION	RECOMMENDED ACTION
Too Little	Increase gas flow to avoid depletion of oxygen in the circuit.
Too Much	Decrease gas flow to minimize waste.

Calculations

Whenever calculations are required to configure parameter displays or annotate patient records, the clinician can use the calculator available on the Narkomed 6400. The calculator is part of the utilities notebook.

To access the calculator:

1. Press **[To Secondary Keys]** on the main screen taskbar.
Several control buttons change to choose additional tasks.
2. Press **[Utilities Notebook]** on the new taskbar. The calculator page appears.

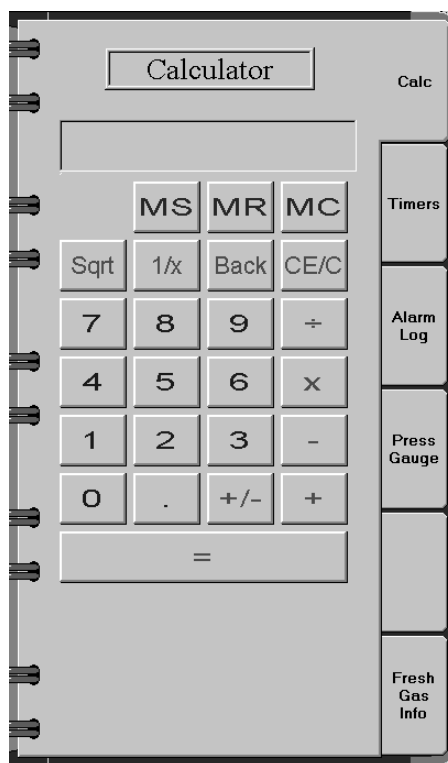


Figure 3-28. Calculator Page in Utilities Notebook

Similar to many pocket calculators, the monitor calculator has a display area for numbers; a memory where values may be stored, read, and cleared; addition, subtraction, multiplication, and division of numbers; as well as square root, reciprocal, back out, and clear entry functions. The calculator displays **ERROR** if the clinician attempts either division by zero or the square root of a negative number. The calculator displays an **M** when a number is entered into memory. Any stored number remains available after the utilities notebook is closed and subsequently reopened.

Timers

Whenever a countdown timer or an elapsed time measurement is needed, the clinician can use the timers available on the Narkomed 6400. These timers are available from the Timers page of the utilities notebook.

To use a countdown timer:

1. Press **[To Secondary Keys]** on the main screen taskbar.
Several control buttons change to choose additional tasks.
2. Press **[Utilities Notebook]** on the new taskbar. The utilities notebook appears.
3. Press the **[Timers]** tab to access the timers page.

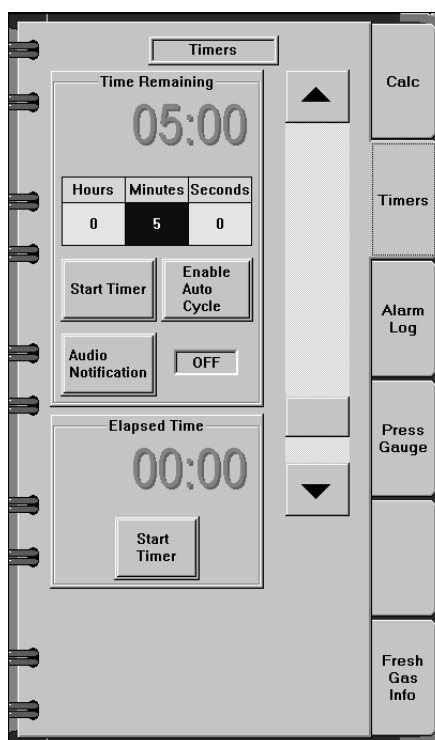


Figure 3-29. Timers Page in Utilities Notebook

4. Touch either the hours, minutes, or seconds display field. A slider will appear that allows the clinician to set the countdown timer.
5. Touch the start timer button to start the countdown timer. The time remaining is displayed on the notebook page and in the title bar.
6. If the Enable Auto Cycle button is pressed, the countdown timer will restart each time it reaches zero. The descriptive text of this button changes to read Disable Auto Cycle. Pressing the Disable Auto Cycle button causes the timer to stop when it reaches zero.

7. Audio notification can be enabled to sound a tone when the countdown timer times out.

Once the timer is started, the Start Timer button text changes to read Stop Timer. Pressing this button will stop the countdown timer.

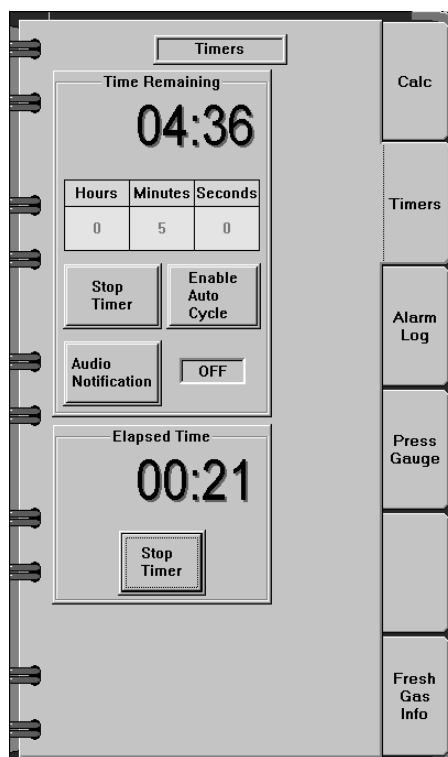


Figure 3-30. Timers Page - Timer Running

To measure time elapsed:

1. Press **[To Secondary Keys]** on the main screen taskbar.
Several control buttons change to choose additional tasks.
2. Press **[Utilities Notebook]** on the new taskbar. The utilities notebook appears.
3. Press the **[Timers]** tab to access the timers page.
4. Press the Start Timer button in the Elapsed Time block. The elapsed time is displayed on the notebook page and in the title bar.
5. When the timer starts the text of the Start Timer button now changes to read Stop Timer. Pressing this button will stop the timer.

Both the countdown timer (remaining time) and elapsed time will continue to be displayed on the title bar when the Utilities Notebook is closed.

Alarm Log

The alarm log allows the clinician to view all alarm events that have occurred during a patient's case. The log can hold up to 500 alarm events. When this limit is reached, the oldest alarm is removed from the log to make room for the newest alarm.

The first column of the alarm log contains the time the alarm occurred. The second column contains the time the alarm was cleared; if the alarm is still active, then this column contains dashes. The third column contains the alarm message, with the background color matching the urgency of the alarm (red for warnings, yellow for cautions, and white for advisories.)

The alarm log page also has control buttons for clearing the alarm log and for removing all advisories from the log display. The alarm log page is part of the utilities notebook.

To display the alarm log page:

1. Press **[To Secondary Keys]** on the main screen taskbar.
Several control buttons change to choose additional tasks.
2. Press **[Utilities Notebook]** on the new taskbar. The utilities notebook appears.
3. Press the **[Alarm Log]** tab to access the alarm log page.

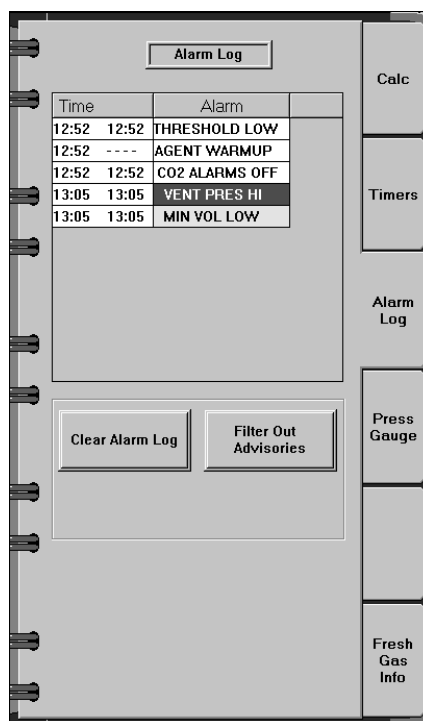


Figure 3-31. Alarm Log Page in Utilities Notebook

To get more information about a specific alarm event, the clinician can touch that alarm in the alarm log, and the data log and trend corresponding to the time of the event will be displayed on the screen with the alarm log on top. This allows the clinician to view the case conditions at the time the alarm event occurred. The row in the data log for the time of the alarm will be highlighted for easy reference. Touching an entry in the data log will remove the alarm log from the screen. To view the trend area after touching an alarm, touch the **[Main Screen]** button.

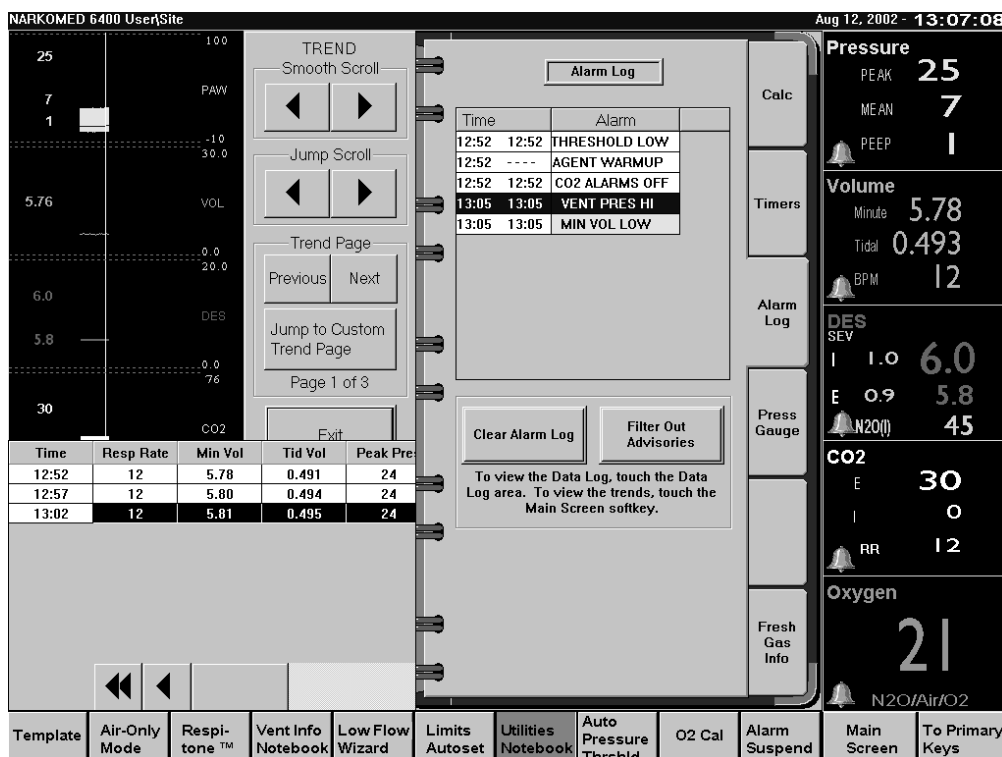


Figure 3-32. Alarm Log Page with Data Log and Trend

Clearing the
Alarm Log

To clear all entries in the alarm log, touch the **[Clear Alarm Log]** button. A confirmation dialog box is displayed:

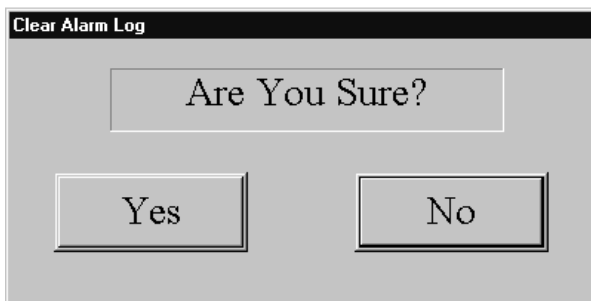


Figure 3-33. Alarm Log Clear Confirmation Dialog Box

- Touch **[No]** to clear the dialog box from the screen without clearing the alarm log.
- Touch **[Yes]** to clear the alarm log.

All entries in the alarm log are now cleared, and an entry containing the phrase “Alarm Log Cleared” and the time is then created as the first entry in the cleared alarm log.

Note: The alarm log is cleared automatically when the clinician exits Standby Mode with the **[New Case]** button. An entry containing the phrase “New Case” and the time is then created as the first log entry in a new case.

Note: The alarm log can also be cleared by touching the **[Clear Trend]** button. An entry containing the phrase “Alarm Log Cleared” and the time is then created as the first entry in the cleared alarm log. For complete information, see “Clear Trends” on page 8-12.

Removing Advisories from the Alarm Log Display

To remove all advisory alarms from the alarm log display, touch the **[Filter Out Advisories]** button. The advisories are removed, and the button label changes to **[Display Advisories]**. Touching the button a second time will cause the advisories to be displayed again and the button label to change back to **[Filter Out Advisories]**.

Software Pressure Gauge

The software pressure gauge provides graphic, numeric, and audio information for improved pressure monitoring. A graphic pressure gauge can be displayed using the **[Press Gauge]** control button on the main task bar. The gauge can also be displayed as part of the Utilities notebook, which provides additional controls and display options. Both ways are described below.

An audio tone is available which is sounded when the pressure reaches a set threshold. The audio tone is enabled and disabled by touching the audio speaker button inside the gauge. When the audio tone is enabled, a gray line appears extending from the center of the gauge to indicate the audio tone's set threshold value. This threshold value is also displayed in numerics in the center of the gauge. When the tone is enabled, two arrow buttons also appear next to the gauge. They are used to adjust the threshold value in the range of 10 to 50 cmH₂O in increments of one; the default threshold is 20 cmH₂O.

The volume of the pressure gauge audio tone may be adjusted on the Volume page of the System Setup Notebook.

To display the software pressure gauge from the main task bar:

- press the **[Press Gauge]** control button



Figure 3-34. Software Pressure Gauge - Tone Enabled

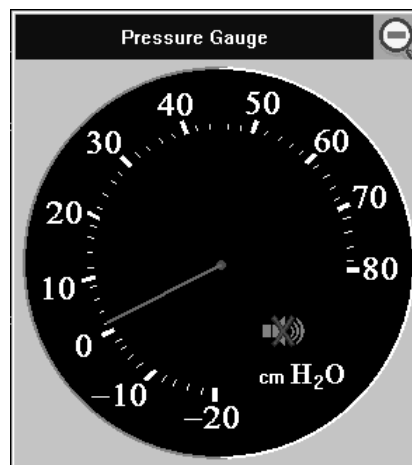


Figure 3-35. Software Pressure Gauge - Tone Disabled

The gauge window can be moved by touching the title bar and dragging it to the new location. It can be minimized by touching the minimize icon in the top right corner of the window, and can be maximized by touching the maximize icon. Whenever the window reappears, it is displayed at its last (most recent) location.

To display the software pressure gauge page from the Utilities notebook:

1. Press **[To Secondary Keys]** on the main screen taskbar.
Several control buttons change to choose additional tasks.
2. Press **[Utilities Notebook]** on the new taskbar. The utilities notebook appears.
3. Press the **[Press Gauge]** tab to access the pressure gauge page.
The page contains a circular analog gauge, numeric values for current pressure, peak pressure, and PEEP, and control buttons.

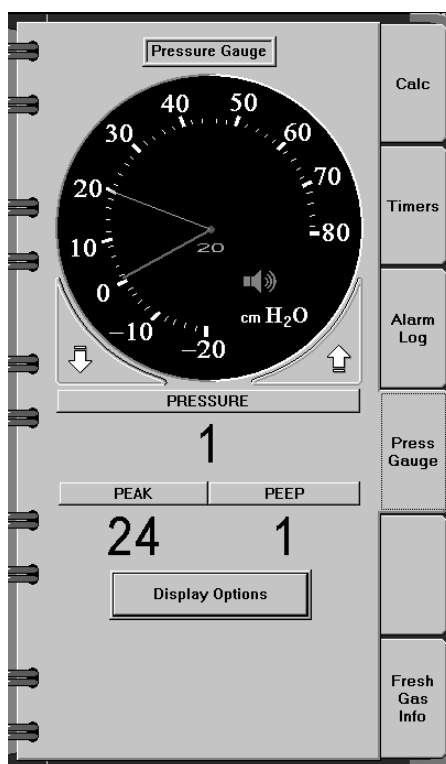


Figure 3-36. Software Pressure Gauge Page in Utilities Notebook

Display Options

Touch the **[Display Options]** button for an alternative way to control display and audio. The circular gauge is removed from the page and replaced with control buttons that allow the clinician to set the audio tone's properties.

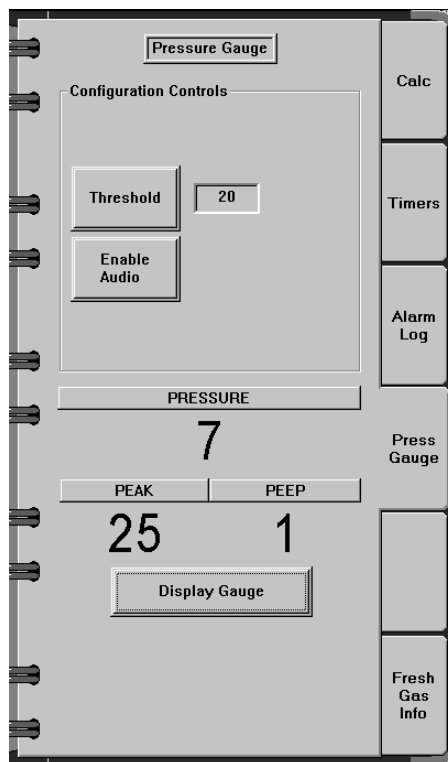


Figure 3-37. Software Pressure Gauge Page in Utilities Notebook - Alternate Display

Setting Audio Tone Threshold

To adjust the audio tone threshold value in the range of 10 to 50 cmH₂O:

1. Touch **[Threshold]** to activate the slider bar.
2. Move the slider control until the preferred setting is displayed next to the **[Threshold]** control button.
 - Use the fine adjustment to change the threshold in increments of 1
 - Use the coarse adjustment to change the threshold in increments of 2.

Enabling/ Disabling the Audio Tone

To enable the audio tone, touch the **[Enable Audio]** button. The audio is enabled, and the button label changes to **[Disable Audio]**. Touching the button a second time will cause the audio to be disabled and the button label to change back to **[Enable Audio]**.

Displaying Gauge

Touch the **[Display Gauge]** button to return the notebook page to the software pressure gauge display.

Fresh Gas Information

The fresh gas information page of the utilities notebook shows current flow and volume readings for air, oxygen, and nitrous oxide, along with accumulated totals. The information is displayed continuously and is updated at least every second. The volume measurements continue to accumulate while in **Monitor Standby**. All totals are reset to zero after power-up or selecting **[New Case]**.

The page also contains control buttons to reset volume totals, select flow threshold, and set the high fresh gas flow alarm delay.

The display range for volume is 0 to 9999 liters. The display range for flow is 0.0 to 12.0 L/min. An overrange condition (a flow higher than 12 L/min) for any of the gases will be indicated as ">12.0" in the flow display window for that gas along with the symbol ">" in the TOTAL flow display. When the overrange condition is resolved, resetting volume measurements will remove the overrange indicators. If data for any gas is unavailable, the flow display for that gas will indicate "INOP", and the symbol ">" will be added to the TOTAL flow display.

To access the fresh gas information page:

1. Press **[To Secondary Keys]** on the main screen taskbar.
Several control buttons change to choose additional tasks.
2. Press **[Utilities Notebook]** on the new taskbar. The utilities notebook appears.
3. Press the **[Fresh Gas Info]** tab to access the fresh gas information page.

Current Fresh Gas Usage		
	Flow (L/min)	Volume (Liters)
Air	3.0	2
Oxygen	3.0	2
N2O	2.6	1
TOTAL	8.6	5

Volume totals are reset automatically on each New Case or Power up

Reset Volume Totals Last reset on: October 11, 2002 15:51

High Fresh Gas Use Alarm

Set Time Delay Time Delay (Minutes): OFF

Flow Rate Threshold 4.0 L / m

Buttons on the right: Calc, Timers, Alarm Log, Press Gauge, Fresh Gas Info

Figure 3-38. Fresh Gas Info Page in Utilities Notebook

- Reset Volume Totals** Touch the **[Reset Volume Totals]** control button to reset all accumulated volumes to zero. A text box next the control button indicates the date when the volumes were last reset.
- Set Time Delay** Use this option to select a time delay for the high fresh gas usage alarm. This advisory alarm will be displayed and annunciated when the total fresh gas flow is consistently above the flow rate threshold for a time period longer than the specified delay (in minutes). If the flow rate falls below the threshold, the alarm is removed and the delay period is restarted. The time remaining for the delay is shown in the text box next to the control button.
- Touch the **[Set Time Delay]** control button until the desired time delay period is displayed. The options are OFF, 5, 10, 15, 20, 25, and 30.
- Flow Rate Threshold** Use this option to specify the threshold for the high fresh gas usage alarm. If the flow rate exceeds the threshold, an advisory message is posted in the alarm window and a tone is annunciated.
- To set the threshold within the range of 0.5 to 10 L/min, use the up and down arrow buttons. The threshold is shown in the text box next to the arrow buttons. The factory default is 4 L/min.

Printing Patient Data

If the Narkomed 6400 is configured with a strip chart recorder, the clinician can use it to print waveforms, vital signs reports, and the data log. If the Narkomed 6400 is configured with the external sheet printer interface, the clinician can use it to print selected data log information.

Print options are selected in the Print notebook which is accessed by pressing the **[Print]** button on the main screen taskbar. The print notebook contains two pages for strip chart recorder control and two pages for external printer control.

The Strip Chart Recorder Print Options Page in the Print Notebook

To display the strip chart recorder print options page of the print notebook, press **[Print]** on the main screen taskbar.

This page is used to start and stop various types of printed output to the strip chart recorder and shows print status at the bottom.

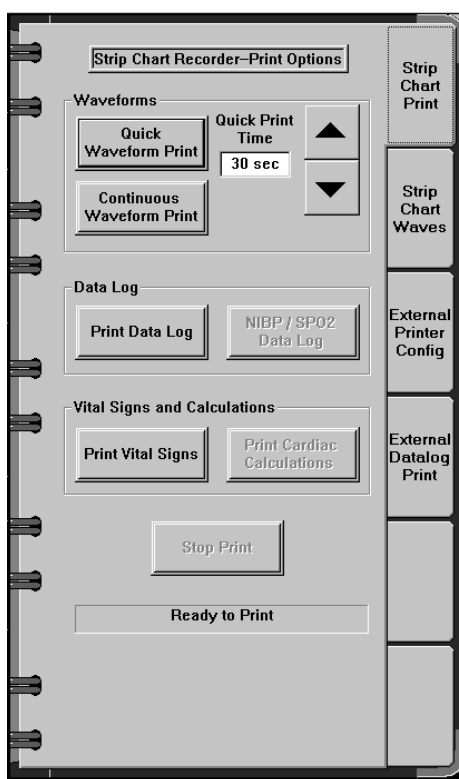


Figure 3-39. Strip Chart Recorder Print Options Page in Print Notebook

Quick Waveform Print

Touch **[Quick Waveform Print]** to initiate a quick print of the currently configured waveform(s). The duration of the print can be selected by the clinician in the range of 5 to 30 seconds using the up and down arrow buttons. While the print is taking place, a message appears at the bottom of the options page showing the remaining print time. All other control buttons on the options page are disabled until the print is completed, with the exception of the **[Stop Print]** button.

Examples of waveform printouts are shown in the following figures. Waveform printouts show patient name, date and time, and measurement scales. The scales of the waveform printouts match their corresponding scales on the display, with the exception of the CO₂ waveform. The CO₂ waveform is scaled separately for the printout and may not match the scale on the display. The date and time reflect the time of the oldest waveform sample.

The waveform printouts have various annotations specific to the parameter printed above and below the waveforms.

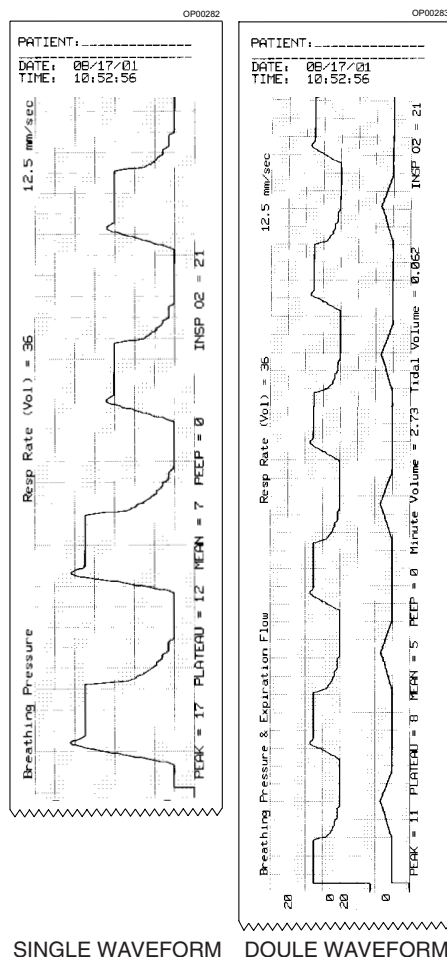


Figure 3-40. Examples of Waveform Prints

Continuous Waveform Print

Touch **[Start Continuous Waveform Print]** to initiate a continuous printing of the currently configured waveform(s). The printing continues indefinitely until the **[Stop Print]** button is pressed. While the print is taking place, a message appears at the bottom of the options page showing the time elapsed in seconds since the start of the print. All other control buttons on the options page are disabled until the print is completed, with the exception of the **[Stop Print]** button.

This control button provides the same function as the Record Wave key on the front of the strip chart recorder.

Print Data Log

Touch **[Print Data Log]** to initiate the printing of the data log. While the print is taking place, the message "Data Log Print in Progress" appears at the bottom of the options page. All other control buttons on the options page are disabled until the print is completed, with the exception of the **[Stop Print]** button.

OP00285

PATIENT: _____											
DATE: 08/17/01											
TIME: 10:53:39											
EV#	Time	Resp Rate	Min Vol	Tid Vol	Peak Pres	Mean Pres	PEEP	Plat Pres	O2	Agt I / E	ET CO2
10	10:51	36	2.36	0.119	24	10	0	16	21		11 mmHg
9	10:50	36	2.15	0.062	11	5	0	8	21		
8	10:49	36	3.03	0.062	11	5	0	8	21		
7	10:48	36	3.18	0.090	17	7	0	12	21		
6	10:47	36	4.07	0.090	17	7	0	12	21		
5	10:46	36	4.16	0.119	24	10	0	16	21		6 mmHg
4	10:45	30	4.13	0.119	24	10	0	16	21		
3	10:44								21		
2	10:43								21		
1	10:42								21		

Figure 3-41. Example of a Data Log Report

Each page of the printed data log contains up to ten entries, with the most recent entry first. If there are more than ten entries, a vertical divider appears between the pages. If monitoring information for a particular parameter is invalid or not available, dashes appear for that parameter on the printed data log.

Data log entries colored in red on the screen (to indicate a Warning alarm condition) will have the letter “W” next to the time column on the printed data log. Data log entries colored in yellow on the screen (to indicate a Caution alarm condition) will have the letter “C” next to the time column on the printed data log.

This control button provides the same function as the Print Data Log key on the front of the strip chart recorder.

Print Vital Signs

Touch **[Print Vital Signs]** to initiate the printing of the vital signs report. While the print is taking place, the message “Vital Sign Print in Progress” appears at the bottom of the options page. All other control buttons on the options page are disabled until the print is completed, with the exception of the **[Stop Print]** button.

If monitoring information for a particular parameter is invalid or not available, dashes appear for that parameter on the printed report.

OP00652

PATIENT: _____			
DATE: 11/13/01			
TIME: 09:03:54			
VENTILATION			
MINVOL	5.94	PEAK	22
TIDVOL	0.760	PLAT	21
RATE	8	MEAN	9
		PEEP	1
GAS CONCENTRATION			
	MEAN	INSP	EXP
O2	----	21	----
CO2	----	37	1
SEV	----	2.1	1.9
N2O	----	45	----
CO2 UNITS		mmHg	

Figure 3-42. Example of a Vital Signs Report

Stop Print

Touch **[Stop Print]** to stop the current print process. This button is enabled only while the strip chart recorder is printing.

This control button provides the same function as the Stop key on the front of the strip chart recorder.

Note: The **[NIBP/SPO2 Data Log]** and **[Print Cardiac Calculations]** control buttons are enabled only if the Narkomed 6400 is configured with an Integrated Patient Monitor. For complete information, see the *Operator's Manual for the Integrated Patient Monitor (IPM) Option*.

The Strip Chart Recorder Configuration Page of the Print Notebook

To display the strip chart recorder configuration page of the print notebook:

1. Press **[Print]** on the main screen taskbar. The strip chart recorder print options page of the print notebook appears.
2. Press the **[Strip Chart Waves]** tab in the print notebook to display the strip chart recorder print configuration page.

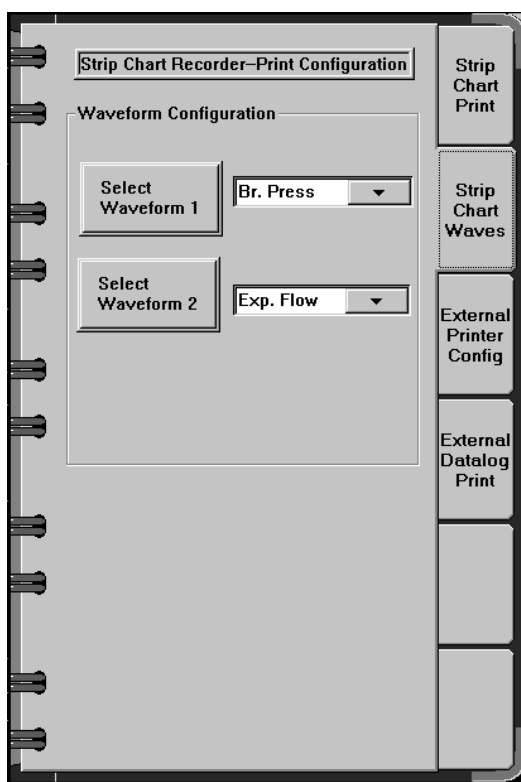


Figure 3-43. Strip Chart Recorder Print Configuration Page in Print Notebook

Selecting Waveforms

1. Touch **[Select Waveform 1]** or its associated selection field to display a drop-down list of all waveforms currently available for printing.
2. Touch the desired waveform in the drop-down list to select it.

Repeat this procedure for the second waveform. The selection list for Waveform 2 contains only selections that have not been chosen for the Waveform 1 to prevent printing the same waveform more than once in a single printout.

The External Printer Configuration Page in the Print Notebook

To display the external printer configuration page of the print notebook:

1. Press **[Print]** on the main screen taskbar. The strip chart recorder print options page of the print notebook appears.
2. Press the **[External Printer Config]** tab in the print notebook to display the external printer configuration page.

This page is used to select the printer driver and the page order of the printed output.

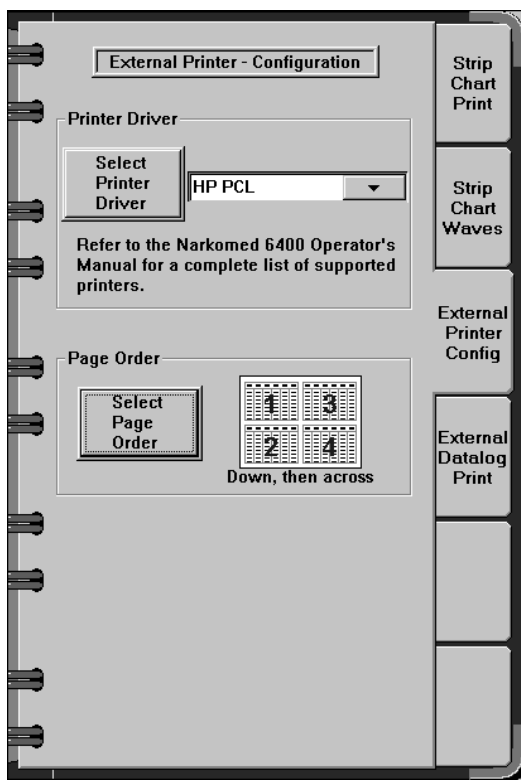


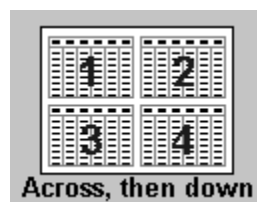
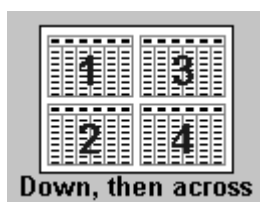
Figure 3-44. External Printer Configuration Page in Print Notebook

Select Printer Driver

1. Touch **[Select Printer Driver]** or its associated selection field to display a drop-down list of available printer drivers. The choices are **HP PCL**, **PCL 5**, **HP LJ1200 Series**, and **None**. (For a list of supported printer models, see "Printer Drivers/Models Supported by the Narkomed 6400" on page A-1-19.)
2. Touch the desired driver in the drop-down list to select it.

Select Page Order

1. Touch **[Select Page Order]** or the graphic next to it to toggle between the two choices: **Down, then across** and **Across, then down**.



The External Printer Print Options Page in the Print Notebook

To display the external printer options page of the print notebook:

1. Press **[Print]** on the main screen taskbar. The strip chart recorder print options page of the print notebook appears.
2. Press the **[External Datalog Print]** tab in the print notebook to display the external printer print options page.

This page is used to start and stop various types of data log printouts to the external sheet printer and shows print status at the bottom.

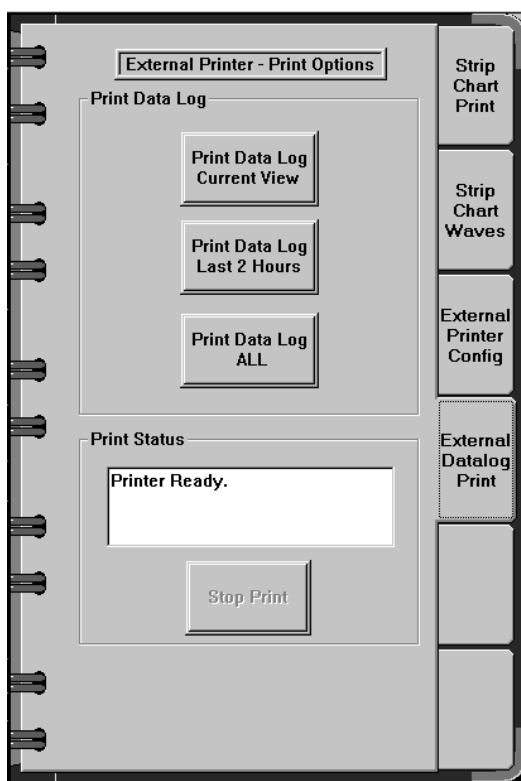


Figure 3-45. External Printer Print Options Page in Print Notebook

Print Data Log Current View

Touch **[Print Data Log Current View]** to initiate a single sheet printout of the currently displayed data log window. Any additional data log information currently off the screen will continue to print so as to fill a single 8.5" x 11" sheet of paper in a landscape orientation. While the print is taking place, a message appears at the bottom of the print page showing the print status. All other control buttons on the print page are disabled until the print is completed, with the exception of the **[Stop Print]** button.

The printed page shows the date and time of the printout, the total number of pages, and the serial number of the anesthesia machine. See Figure 3-46.

Notes:													
Time	HR	SpO2	SpO2 Pulse	ET CO2	INSP CO2	N2O(I)	Resp Rate	P1 S/D	P1 Mean	P2 S/D	P2 Mean	P3 S/D	P3 Mean
10:44	60	96	60	75 mmHg	38 mmHg	0	7	101 / 68	78 ART	24 / 9	14 FEM	23 / 9	14 PA
10:46	60	96	60	75 mmHg	38 mmHg	77	7	100 / 67	78 ART	24 / 9	14 FEM	23 / 9	13 PA
10:48	60	96	60	75 mmHg	38 mmHg	77	7	98 / 66	77 ART	24 / 9	14 FEM	23 / 9	13 PA
10:50	60	96	60	75 mmHg	38 mmHg	0	7	100 / 67	78 ART	24 / 9	14 FEM	23 / 9	13 PA
10:52	60	96	60	75 mmHg	38 mmHg	0	7	101 / 68	78 ART	24 / 9	14 FEM	23 / 9	13 PA
10:54	60	96	60	75 mmHg	38 mmHg	0	7	101 / 68	78 ART	24 / 9	14 FEM	23 / 9	13 PA
10:56	59	96	60	75 mmHg	38 mmHg	77	7	101 / 68	79 ART	24 / 9	14 FEM	23 / 9	13 PA
10:58	60	96	60	75 mmHg	38 mmHg	77	7	101 / 68	78 ART	24 / 9	14 FEM	23 / 9	14 PA
11:00	60	96	60	75 mmHg	38 mmHg	77	7	101 / 68	79 ART	24 / 9	14 FEM	23 / 9	13 PA
11:02	60	96	60	75 mmHg	38 mmHg	0	7	101 / 68	79 ART	24 / 9	14 FEM	23 / 9	14 PA
11:04	59	96	60	75 mmHg	38 mmHg	0	7	100 / 67	78 ART	/	14 CVP	23 / 9	14 PA

Page: 1 of 1 Date: 03/17/2004 Time: 11:05 Narkomed 6400 S/N: 12345678

Figure 3-46. Example of Current View Data Log Printout on External Printer

Print Data Log Last 2 Hours

Touch **[Print Data Log Last 2 Hours]** to initiate a multiple (8.5" x 11") sheet printout of the last two hours of data log information. The printout will have a landscape orientation. While the print is taking place, a message appears at the bottom of the print page showing the print status. All other control buttons on the print page are disabled until the print is completed, with the exception of the **[Stop Print]** button.

The printed pages show the date and time of the printout, the total number of pages, and the serial number of the anesthesia machine.

Print Data Log ALL

Touch **[Print Data Log ALL]** to initiate a multiple (8.5" x 11") sheet printout of the entire contents of the data log. While the print is taking place, a message appears at the bottom of the print page showing the print status. All other control buttons on the print page are disabled until the print is completed, with the exception of the **[Stop Print]** button.

The printed pages show the date and time of the printout, the total number of pages, and the serial number of the anesthesia machine.

Stop Print

Touch **[Stop Print]** to stop the current print process. This button is enabled only while the sheet printer is printing.

Alarm Window

Adjustments

The alarm window can be moved or its size changed. The magnifying glass icon in the upper right corner indicates the window sizing status. When the window is minimized, a plus sign overlays the icon. When the window is at full size, a minus sign overlays the icon.

ALARMS

To move the alarm window to a new location on the screen, touch the title bar and drag the window to the new location. The window is confined to the waveform area. It cannot cover any parameter boxes or control buttons.

If a notebook is opened where the alarm window is located, the alarm window always appears on top of the notebook. If a data log or trend window is open, the alarm window is on top. Whenever the alarm window reappears, it is displayed at its last (most recent) location.





To minimize the size of the alarm window, touch the minimize icon (the magnifying glass with a blue minus sign) in the top right corner of the alarm window.

The window contracts to display only warnings and cautions and the alarm status icon. Any existing advisories, except **ALARMS SUSPEND**, cannot be viewed without maximizing the window. The window automatically expands to display all advisories whenever new advisories appear.



To maximize the size of the alarm window, touch the maximize icon (a magnifying glass with a red plus sign) in the top right corner of the alarm window. The window expands to redisplay all active advisories.

The following table summarizes the alarm window size conditions:

Original Condition	Clinician's Selection	Response
Maximized Window (default)	Touch  icon	The alarm window will display only active warning and caution alarms or the ALARMS SUSPEND advisory. If any new advisory occurs, all advisories will reappear.
Minimized Window	Touch  icon	The alarm window will expand to include all active alarms and advisories.

Silencing Audible Alarms

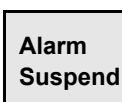


To silence all audible alarms, touch the **[ALARM SILENCE]** control button in the alarm window. This control button silences current alarms for 60 seconds if pressed once, 120 seconds if pressed twice.

A timer showing the time remaining in the silence period is displayed in the alarm window. Pressing the **[ALARM SILENCE]** button while in an alarm silence period sets the silence time to its maximum of 120 seconds.

If a different alarm event occurs during the silence period, a single annunciator sounds to indicate the new condition.

Suspending Alarms



To suspend most alarms, touch the **[Alarm Suspend]** control button located in the taskbar at the bottom of the screen. Its label changes to **[Cancel Alarm Suspend]**.

Patient alarms are suspended indefinitely. Machine alarms are still active. (See “Summary of Alarm Messages and Indications in Appendix A for the list of patient and machine alarms.) Warnings and cautions are removed from the window. However, the advisories are still displayed, and an **ALARMS SUSPEND** message is displayed in the alarm window.

Breathing pressure alarms are not affected by the **[Alarm Suspend]** control if the ventilator is in Volume, Pressure or SIMV Mode or if ventilator communications have failed. Oxygen and CO₂ alarms are not affected by the **[Alarm Suspend]** control in any ventilator mode.

Canceling Alarm Suspension

To cancel the alarm suspension for all alarms, touch the **[Cancel Alarm Suspend]** control button. Alarm suspension for all alarms is also canceled by touching the bell icon for any individual parameter, with the exception of the CO₂ alarm. CO₂ alarm state is not affected by the **[Cancel Alarm Suspend]** control.

Controlling Individual Alarms

There are two ways to activate, deactivate, or put the alarm notification systems for each monitoring function in **Alarm Standby**. Each parameter box has a bell icon for changing the status. Touch the bell icon to change the alarm status.

Note: O₂ alarms and breathing pressure alarms do not have an **Alarm Standby** control. They are either **ON** or **OFF**.

Note: The clinician cannot change O₂ alarm status by touching the bell icon. O₂ alarm status is always determined by the Narkomed 6400.

Note: During automatic ventilation, CO₂ alarms can be set to **OFF** only when Full CO₂ Control is enabled. See “Carbon Dioxide Alarm Management” on page 4-14 for complete information.

The clinician may also set the alarm status for each parameter (except O₂) on the alarm page of each parameter notebook. Information about setting the alarm status in the notebook is included the Sections 4 and 5, which describe the monitoring configurations and functions for specific notebook alarm setup.

The bell icons display alarm status. Touching the bell icon cycles the alarm notification system from **OFF** to **Alarm Standby** to **ON**, then back to **OFF** (pressure alarms may only be toggled between **ON** and **OFF**). The icon changes in appearance to indicate the current state of the alarm as follows:



When the alarm notification system is **ON**, the icon is colored.



When the alarm notification system is **OFF**, a yellow **X** overlays the bell.



When the alarm notification system is in **Alarm Standby** status, the bell is dimmed (grayed out).

Turning the Alarm OFF or ON

To turn the alarm **OFF**, touch the bell icon in the parameter box until it shows a crossed-out bell. The O₂ alarms can not be turned off, but are always on if a sensor is connected and in calibration.

To turn the alarm **ON**, touch the bell icon in the parameter box until it shows a bell that is colored and is not crossed out.

Setting Alarm Standby Status

In **Alarm Standby** status audible and visual alarms and advisories due to absent signals are disabled. When technically valid data is detected, **Alarm Standby** status automatically changes, and annunciators are **ON** for that parameter.

Volume and oxygen alarms turn off if their respective cables are disconnected. When the cable is reconnected, the volume alarms automatically change to **Alarm Standby** status. However, when the oxygen sensor is reconnected, the Narkomed 6400 automatically prompts the clinician to calibrate the sensor, and oxygen alarms remain off until the calibration is successfully completed.

To activate **Alarm Standby** status, touch the bell icon in the parameter box until the bell is dimmed (grayed out). The alarm remains in **Alarm Standby** until valid technical data is detected that automatically turns the alarm notification system back on, or the clinician turns the alarm **ON** manually.

Note: The status of pressure and CO₂ alarms is limited by the ventilator state. See “Effects of Ventilator Modes on Alarm Management” below.

Most alarms are automatically set to **Alarm Standby** after pressing the **[New Case]** control button, thereby canceling **Monitor Standby** status. This also depends on the status of the ventilator. See “Case Selection Dialog Box” on page 8-4 for further information.

Changing Alarm Limits

If the clinician touches an alarm that is related to the alarm limits (e.g., % INSP O₂ LOW), the Alarm Limits page of the Setup notebook is automatically displayed with the relevant alarm selected. This allows the clinician to rapidly adjust the limit. If the clinician touches an alarm not related to the limits, a hint message “Selected Alarm has no limits.” will be displayed.

Effects of Ventilator Modes on Alarm Management

Selection of specific ventilator modes affects the ability of some alarms to be further controlled by the clinician. The following table summarizes ventilator mode control of monitoring alarms:

Ventilator Operating Status	Monitoring Alarms Status
Ventilator Standby Mode	breathing pressure, respiratory volume, CO ₂ , and agent alarms are turned OFF (CO ₂ alarm may be set to ON in Ventilator Standby)
Any ventilation mode	breathing pressure and respiratory volume alarms are forced ON ; CO ₂ and agent alarms are set to Standby
Any automatic ventilation mode	breathing pressure and CO ₂ alarms can not be turned OFF (CO ₂ alarm may be set to Standby ; may also be set to OFF in Full Control CO ₂ mode)
Manual/Spontaneous Mode	all parameter alarms (except O ₂) can be turned OFF

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4

Configuration and Settings - Gas Analysis

The Narkomed 6400 monitoring system can be configured to meet the specific needs of an individual clinician or hospital for receiving data collected by the gas analysis pod.

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Default Values

Settings will return to their default values after power up or selecting **[New Case]**. A summary of monitoring default settings appears in the following table.

Parameter	Default Value
Agent high alarm limit	3% isoflurane, enflurane, halothane; 6% sevoflurane; 9% desflurane; Autoset Narrow
Agent low alarm limit	0%, Autoset Narrow
Displayed trace (Agent/N ₂ O)	Agent
Scale	Desflurane - 20%; other agents - 10%
CO ₂ Units	mmHg
End Tidal CO ₂ high alarm limit	Autoset Narrow , 50 mmHg
End Tidal CO ₂ low alarm limit	Autoset Narrow , 8 mmHg
Inspiratory CO ₂ high alarm limit	Autoset Narrow , 4 mmHg
Audio alarm silence	120 seconds

Configuring Nitrous Oxide and Agent Displays

Nitrous oxide (N₂O) and agent readings and calculations appear in the third waveform channel and parameter box on the main screen. When the gas analysis pod identifies the anesthetic agent, its label is displayed in the parameter box. Up to two agents (primary and secondary) can be displayed in the parameter box. The label for either the primary anesthetic agent or nitrous oxide appears on the waveform, depending upon which trace has been selected by the clinician. The default setting is the anesthetic agent. Potential labels include:

Label	Agent	Label	Agent
Agent	No agent is detected	SEV	Sevoflurane
HAL	Halothane	DES	Desflurane
ISO	Isoflurane	ENF	Enflurane

An example of an agent waveform is shown in Figure 4-1. Both high and low scale lines appear on the waveform. The high scale is user-selectable in the agent parameter notebook. The low scale is fixed at 0. The clinician can select either the agent waveform or the N₂O waveform for display. See “Displayed Trace” on page 5 in this section for details.



Figure 4-1. Monitoring Displays for Sevoflurane Agent



Figure 4-2. Agent Parameter Box (Single Agent, Dual Agent, Agent Mix)

The parameter box displays N₂O inspiratory and agent inspiratory and expiratory percentages. Inspiratory values are labeled with an **I** and expiratory values are labeled with an **E**. All values are updated with each breath. The display range for expiratory and inspiratory agent values is as shown in the table below. If an **APNEA-CO₂** warning alarm is posted, inspiratory and expiratory values for CO₂, N₂O, and agent are replaced with mean values and the label **M** appears next to the number.

Agent	Low Range	High Range
Desflurane	0%	20.0%
Enflurane	0%	7.5%
Halothane	0%	7.5%
Isoflurane	0%	7.5%
Sevoflurane	0%	9.0%

The parameter box can also display the Minimum Alveolar Concentration (MAC) level based on the detected agent type and concentration. The display of MAC values can be turned on or off in the agent parameter notebook. See “Agent Setup” on page 4-6 and “MAC Info” on page 4-11 for more information.

If a second agent is identified, both the primary (leading) and secondary agent values appear in the parameter box. The primary agent values are displayed on the right side of the parameter box, and the secondary agent values are displayed on the left side. No secondary agent is displayed if the MAC value of the agent is below 0.1. A secondary agent will become the primary agent if its MAC value exceeds the primary agent's MAC value by 0.2.

When the gas analysis pod detects a mixture of more than two anesthetic agents, the numeric values are removed and the message **AGENT MIX** is displayed in the agent parameter box.

Note: The agent identification technology used by the gas analysis pod continually attempts to match the infrared signature of the sampled gas to a series of stored templates. As a result, during an agent mix condition, the gas analysis pod may identify a third agent which mimics the actual mixture being sampled. When the **AGENT MIX** condition clears, the reported agent label(s) will be accurate.

Caution: The introduction of therapeutic aerosols (bronchodilators, mucolytics, etc.) may cause the Narkomed 6400 gas analyzer to display incorrect agent information for a period of time.

To avoid exposing the gas analyzer to therapeutic aerosols, the sample line may be temporarily disconnected from the circuit prior to administering the aerosols. (**Warning:** Gas analyzer data will not be available until the sample line is reconnected.)

Agent Alarm Annunciation

When the Narkomed 6400 warms up, the default in **Ventilator Standby** status has alarms silenced (bell has **X** through it). Only the oxygen alarms remain enabled at all times. Both the visual and audible agent alarms are disabled. Once the alarms are on, they can be set to **OFF** or **STANDBY** only by touching the agent alarm bell icon or **[Alarm Control]** in the agent/N₂O notebook.

The clinician may configure agent alarm annunciation by touching the agent alarm bell icon until an **X** appears to disable the alarm. Touch the bell again to set the alarm to **STANDBY** and a third time to enable the alarm; the **X** disappears from the display.

If a hardware error occurs in the agent/N₂O monitor, the alarms turn off. When the error condition is corrected, the alarms are enabled again.

Nitrous Oxide and Agent Settings

Setting Up Agent Parameters

Touch the agent parameter box anywhere except the alarm bell to display the agent notebook.

Agent/Nitrous Oxide Site-Scale

The clinician will probably find it convenient to select the trace before setting appropriate parameters for monitoring in the agent notebook. Touch the **[Site-Scale]** tab in the agent notebook to display the site and scale page.

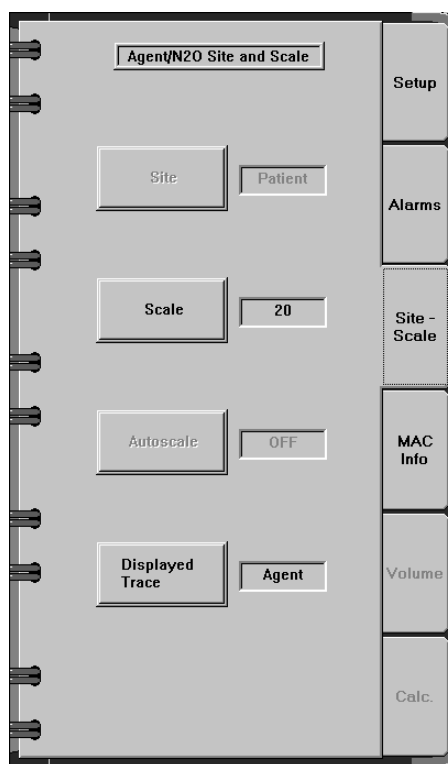


Figure 4-3. Agent/N₂O Site and Scale Notebook

Displayed Trace

The clinician can choose whether the system traces an anesthetic agent or nitrous oxide.

Touch **[Displayed Trace]** until the preferred setting is displayed:

- Agent** the system traces the anesthetic agent (DEFAULT)
- N2O** the system traces nitrous oxide.

The label on the waveform changes to the name of the anesthetic agent or nitrous oxide, as appropriate. The label in the parameter box always displays the dominant anesthetic agent. Changing the displayed waveform will not change the numeric data that is displayed in the parameter box for N₂O inspiratory **[I]** and agent inspiratory **[I]** and expiratory **[E]** percentages.

Scale

This parameter adjusts the scale for the agent and N₂O waveforms.

When **[Agent]** is selected, the scale choices are 2%, 5%, 10%, and 20%. When **[N2O]** is selected, the scale choices are 50% and 100%. Touch **[Scale]** to cycle through the available choices for the particular waveform.

Note: Touching the scale number displayed in the top left part of the waveform also cycles the scale through the available choices for that waveform.

Note: The agent waveform scale is automatically changed to 20% when Desflurane is detected.

Site

This parameter will be available with a future release.

Autoscale

This parameter will be available with a future release.

Agent Setup

Touch the **[Setup]** tab to display the agent setup page. This page is used to configure the sample flow, to enable/disable the display of the MAC value in the agent parameter box, and to calibrate the gas analyzer. For information on calibration, see “Gas Analysis Pod Zero Calibration and Delay” on page 18 in this section.

Note: Because the gas analysis pod monitors both agent/N₂O and CO₂ simultaneously, any changes made on the agent/N₂O **[Setup]** tab will be reflected on the CO₂ **[Setup]** tab.

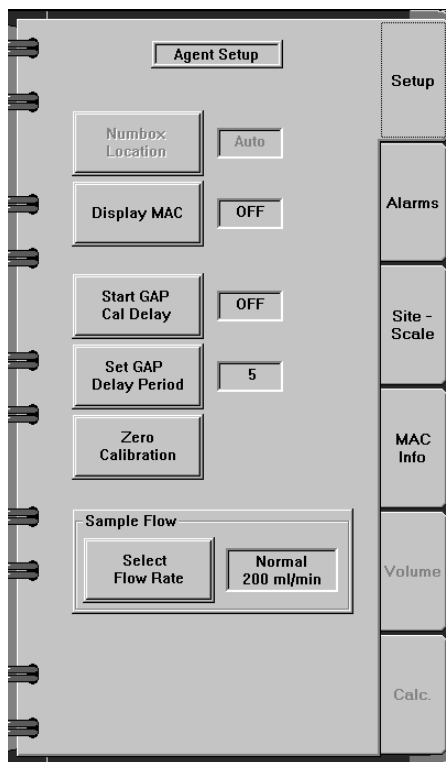


Figure 4-4. Agent Monitoring Setup Page

Display MAC

The clinician may enable or disable the display of a numeric MAC value in the agent parameter box. Touch **[Display MAC]**. The choices include:

- On** the MAC value is displayed in the agent parameter box
- Off** the MAC value is not displayed

Note: When data needed to perform the MAC calculation is unavailable or invalid, the MAC value is automatically removed from the parameter box.

Note: When a mixture of more than two agents is detected, the message **AGENT MIX** is displayed in the parameter box in place of any MAC data currently displayed. After the **AGENT MIX** message is cleared, the MAC display is resumed (if enabled).

Sample Flow - Select Flow Rate

Use this parameter to set the sample flow rate to the gas analysis pod. Touch the **[Select Flow Rate]** button to toggle between a low flow rate of 60 mL/min and a normal flow rate of 200 mL/min (default).

Agent Alarms

Touch the **[Alarms]** tab in the agent notebook to display the alarms page. If the slider bar does not appear, and the inspiratory agent alarm windows are grayed out, then the gas analysis pod has not yet detected any anesthetic agent.

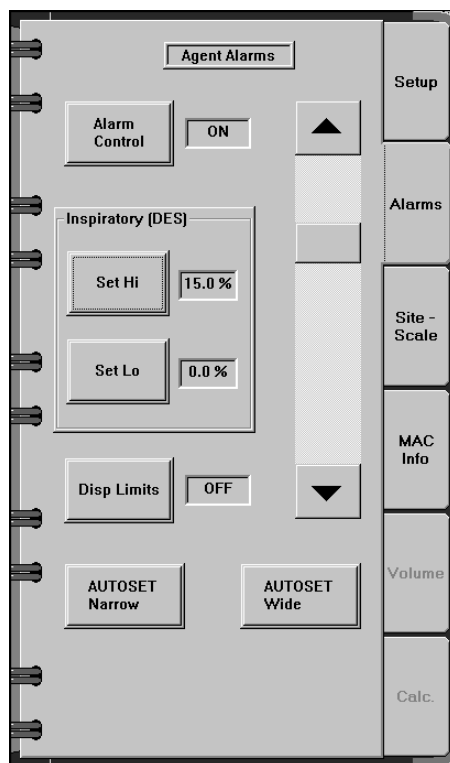


Figure 4-5. Activated Agent Alarms Page

Agent Alarm Management

The clinician may turn the agent alarm notification system on or off. Touch **[Alarm Control]** until the preferred setting is displayed.

- ON** turns the agent alarm notification system on
- OFF** turns the agent alarm notification system off; an **✕** appears on the alarm bell in the agent parameter box
- STBY** turns the agent alarm notification system to **Alarm Standby**.

Note: If valid data is detected by the system, the agent alarm setting will automatically change from **STBY** to **ON**.

Note: Agent alarms will be disabled automatically when the ventilator mode is changed to **Ventilator Standby** status, since no ventilation is possible in **Ventilator Standby**. Turning the ventilator back on will automatically enable these alarms.

Inspiratory Agent – Set High Alarm

This parameter sets the high alarm limit for inspiratory agent measurement. The range of available settings depends on the low alarm setting and the agent used.

Note: This alarm limit cannot be set from the agent parameter notebook unless agent has been detected by the gas analysis pod. If the clinician wishes to set alarm limits before a case, the Alarm Limits Setup page can be used. See “System Alarm Limits” on page 3-15.

Agent	Lowest Limit for High Alarm	Highest Limit
Halothane	low alarm setting + 0.1%	7.5%
Isoflurane	low alarm setting + 0.1%	7.5%
Enflurane	low alarm setting + 0.1%	7.5%
Desflurane	low alarm setting + 0.1%	20.0%
Sevoflurane	low alarm setting + 0.1%	9.0%

1. Touch **[Set Hi]** to activate the slider bar.
2. Move the slider control until the preferred setting is displayed next to the **[Set Hi]** control button.
 - Use the fine adjustment to change the alarm levels by 0.1%
 - Use the coarse adjustment to change the alarm levels by 1.0%.

Inspiratory Agent – Set Low Alarm

This parameter sets the low alarm limits for inspiratory agent measurement. The range of available settings depends on the high alarm setting. The lowest possible setting is zero. The highest possible setting is the current high alarm setting minus 0.1%.

Note: This alarm limit cannot be set from the agent parameter notebook unless agent has been detected by the gas analysis pod. If the clinician wishes to set alarm limits before a case, the Alarm Limits Setup page can be used. See “System Alarm Limits” on page 3-15.

1. Touch **[Set Lo]** to activate the slider bar.
2. Move the slider control until the preferred setting is displayed next to the **[Set Lo]** control button.
 - Use the fine adjustment to change the alarm levels by 0.1%
 - Use the coarse adjustment to change the alarm levels by 1.0%.

Display Agent
Alarm Limits

The clinician may display primary agent/N₂O alarm limits. Touch **[Disp Limits]**. The choices include:

- On** the alarm limits are displayed on the upper right side of the parameter box
- Off** the alarm limits are not displayed.

Note: Display of alarm limits for the secondary agent is not available.

Note: When no breaths are detected by the gas analysis pod (**APNEA-CO2** warning appears in alarm window), alarm limits are automatically removed from the parameter box and only mean values for agent/N₂O are displayed.

AUTOSET
Wide

The clinician may set the alarm limits $\pm 0.2\%$ from the current agent percentage, but not less than 0.1% nor more than the highest setting limit.

Touch **[AUTOSET Wide]**. The change is automatic. The new range values appear next to the **[Set Hi]** and **[Set Lo]** control buttons.

AUTOSET
Narrow

The clinician may set the alarm limits $\pm 0.1\%$ from the current agent reading, but not less than 0.1% nor more than the highest setting limit.

Touch **[AUTOSET Narrow]**. The change is automatic. The new range values appear next to the **[Set Hi]** and **[Set Lo]** control buttons.

Note: The autoset function has no effect if no agent is present or if only mean values are displayed.

MAC Info

Touch the **[MAC Info]** tab in the agent notebook to display the MAC information page. This page contains an explanation of the components of the MAC calculation and a table of unit MAC values for all agents and N₂O. It also references the applicable MAC standard and source of MAC constants.

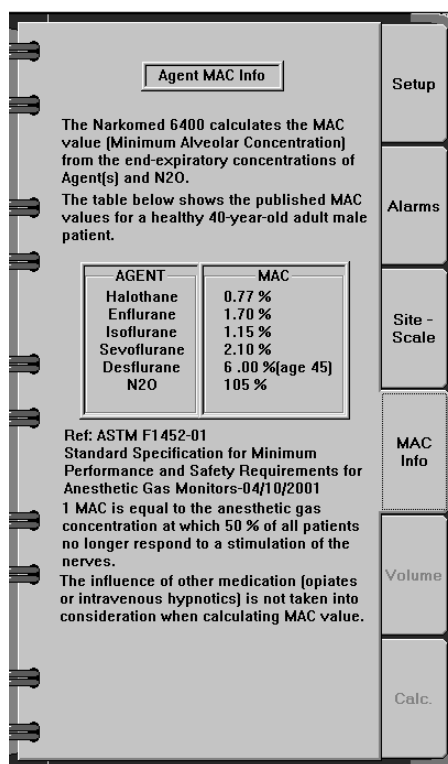


Figure 4-6. MAC Info Page

Configuring Carbon Dioxide Displays

CO₂ readings and calculations appear in the fourth waveform channel and parameter box on the main screen.

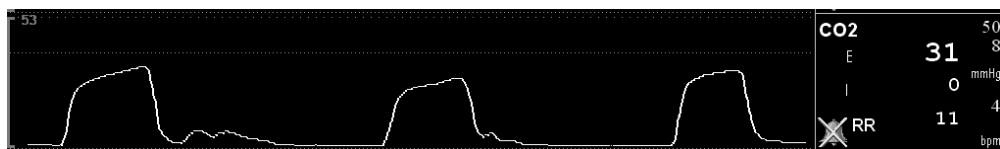


Figure 4-7. Monitoring Displays for Carbon Dioxide

The CO₂ parameter box displays the end tidal (expiratory) and inspiratory CO₂ values and a calculated respiration rate (RR). CO₂ values may be displayed in percent, mmHg, or kPa as selected in the CO₂ parameter notebook. The selected units are shown in the parameter box. The display range for CO₂ values is 0–15%, 0–15.0 kPa, or 0–114 mmHg. Inspiratory values are labeled with an **I** and end tidal values are labeled with an **E**. All values are updated with each breath. When an **APNEA-CO2** warning is present, values are converted to the mean, and **I** and **E** labels change to **M**.

Both high and low scale lines appear on the waveform. The high scale can be set by the clinician at either 7%, 7 kPa, or 53 mmHg; or at 10%, 10kPa, or 76 mmHg (depending on the selected units). The low scale is fixed at zero. A reference line is fixed at 5%, 5 kPa, or 38 mmHg, depending on the selected units.

Carbon Dioxide Alarm Annunciation

When the Narkomed 6400 warms up, the default in **Ventilator Standby** status has alarms silenced (bell has **X** through it). Only the oxygen alarms remain enabled. Both the visual and audible CO₂ alarms are disabled. Once the alarms are on, they can be set to **OFF** or **STANDBY** only by touching the CO₂ alarm bell icon or **[Alarm Control]** in the CO₂ notebook.

The clinician may configure CO₂ alarm annunciation by touching the CO₂ alarm bell icon until an **X** appears to disable the alarm. Touch the bell again to set the alarm to **STANDBY** and a third time to enable the alarm; the **X** disappears from the display. Any time that the CO₂ alarms are disabled, the message **CO2 ALARMS OFF** appears in the alarm window.

Carbon Dioxide Settings

Setting Up Carbon Dioxide Parameters

Touch the CO₂ parameter box anywhere except the alarm bell to display the CO₂ notebook.

Carbon Dioxide Setup

Touch the **[Setup]** tab to display the monitoring setup parameters and programs.

Note: Because the gas analysis pod monitors both CO₂ and agent/N₂O simultaneously, any changes made on the CO₂ setup tab will be reflected on the agent/N₂O setup tab.

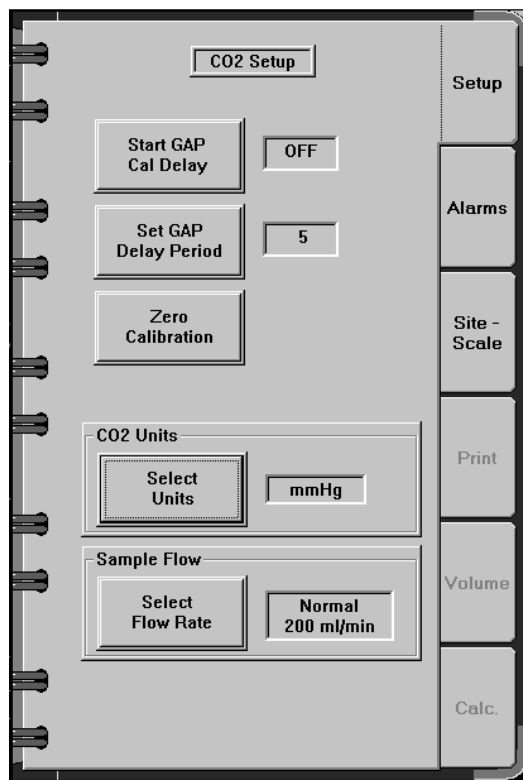


Figure 4-8. CO₂ Monitoring Setup Page

CO₂ Units - Select Units

Use this parameter to select the units in which the CO₂ values will be displayed. Touch the **[Select Units]** button to toggle between mmHg (default), percent, and kPa. The selected units will be used in the CO₂ parameter box, waveform, and trend as well as for the CO₂ alarms on the alarm page and in the parameter notebook.

Sample Flow - Select Flow Rate

Use this parameter to set the sample flow rate to the gas analysis pod. Touch the **[Select Flow Rate]** button to toggle between a low flow rate of 60 mL/min and a normal flow rate of 200 mL/min (default).

Carbon Dioxide Alarms

Touch the **[Alarms]** tab in the CO₂ notebook to display the alarms page.

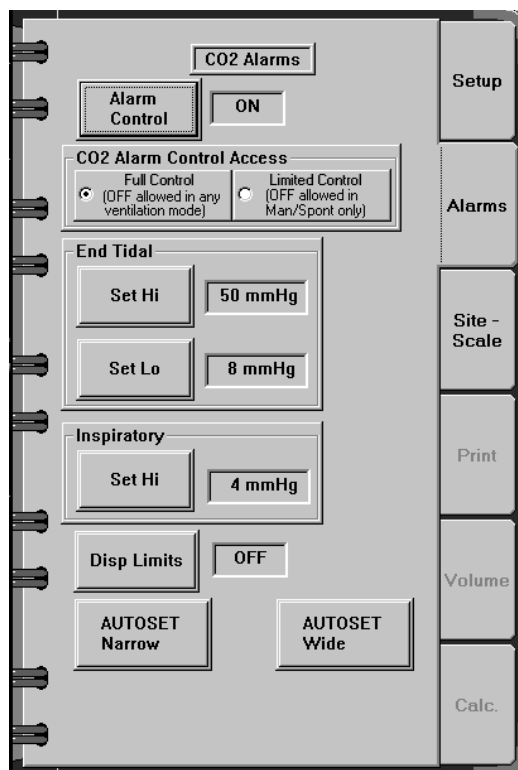


Figure 4-9. CO₂ Alarms Page

Carbon Dioxide Alarm Management

The clinician may turn the CO₂ alarm notification system on or off.

Note: During automatic ventilation, the CO₂ alarms can be set to **OFF** only in Full Control mode. See “CO₂ Alarm Control Access” below for complete information.

Touch **[Alarm Control]** until the preferred setting is displayed:

- ON** turns the CO₂ alarm notification system on
- OFF** turns the CO₂ alarm notification system off; an **X** appears on the alarm bell in the carbon dioxide parameter box and the message **CO₂ ALARMS OFF** appears in the alarm window
- STBY** turns the CO₂ alarm notification system to **Alarm Standby**

Note: If valid data is detected by the system, the CO₂ alarm setting will automatically change from **STBY** to **ON**.

	<p>Note: CO₂ alarms will be automatically turned to OFF when the ventilator mode is changed to Ventilator Standby status, since no ventilation is possible in Ventilator Standby. Turning the ventilator back on will automatically turn these alarms to STBY.</p>
CO ₂ Alarm Control Access	<p>This parameter allows the clinician to choose between two modes of CO₂ alarm control: Full Control and Limited Control. This setting determines whether or not CO₂ alarms can be turned off during automatic ventilation.</p> <ul style="list-style-type: none"> • Touch [Full Control] to allow the clinician to turn CO₂ alarms OFF during automatic ventilation. • Touch [Limited Control] to prohibit the clinician from turning CO₂ alarms OFF during automatic ventilation. <p>Note: Selecting Limited Control mode when CO₂ alarms are set to OFF will automatically change the alarms to STBY.</p> <p>Note: There are four instances where the clinician is able to turn the CO₂ alarms off while in Limited Control mode:</p> <ul style="list-style-type: none"> • a LINE BLOCK advisory is active • a CO₂ zero calibration is in progress • a SERVICE GAP advisory is active • the Divan is set to Ventilator Standby status
End Tidal–Set High Alarm	<p>This parameter sets the high alarm limit for end tidal measurements. The range of available settings depends on the low alarm setting. The lowest possible setting for the high alarm limit is 0.1% more than the current low alarm setting. The highest possible setting is 9.9%.</p> <ol style="list-style-type: none"> 1. Touch [Set Hi] to activate the slider bar. 2. Move the slider control until the preferred setting is displayed next to the [Set Hi] control button. <ul style="list-style-type: none"> • Use the fine adjustment to change the alarm levels by 0.1% • Use the coarse adjustment to change the alarm levels by 1.0%.

End Tidal – Set Low Alarm	<p>This parameter sets the low alarm limit for end tidal measurement. The range of available settings depends on the high alarm setting. The lowest possible setting for the low alarm limit is zero. The highest possible setting is the current high alarm setting minus 0.1%.</p> <ol style="list-style-type: none"> 1. Touch [Set Lo] to activate the slider bar. 2. Move the slider control until the preferred setting is displayed next to the [Set Lo] control button. <ul style="list-style-type: none"> • Use the fine adjustment to change the alarm levels by 0.1% • Use the coarse adjustment to change the alarm levels by 1.0%.
Inspiratory– Set High Alarm	<p>This parameter sets the high alarm limit for inspiratory measurements. The range of available settings is 0% to 9.9% in increments of 0.1%.</p> <ol style="list-style-type: none"> 1. Touch [Set Hi] to activate the slider bar. 2. Move the slider control until the preferred setting is displayed next to the [Set Hi] control button. <ul style="list-style-type: none"> • Use the fine adjustment to change the alarm levels by 0.1% • Use the coarse adjustment to change the alarm levels by 1.0%.
Display CO ₂ Alarm Limits	<p>The clinician may display carbon dioxide alarm limits.</p> <p>Touch [Disp Limits]. The choices include:</p> <p>On the alarm limits are displayed on the upper right side of the parameter box.</p> <p>Off the alarm limits are not displayed.</p> <p><i>Note:</i> When no breaths are detected by the gas analysis pod (APNEA-CO2 warning appears in alarm window), alarm limits are automatically removed from the parameter box and only mean values for CO₂ are displayed.</p>
AUTOSET Wide	<p>The clinician may set the alarm limits $\pm 0.5\%$ from the current end tidal reading and $+0.5\%$ from the current inspiratory reading, but not less than 0 nor more than 9.9%.</p> <p>Touch [AUTOSET Wide]. The change is automatic. The new range values appear next to the [Set Hi] and [Set Lo] control buttons.</p>

AUTOSET Narrow

The clinician may set the alarm limits $\pm 0.4\%$ from the current end tidal reading and $+0.4\%$ inspiratory reading, but not less than 0 nor more than 9.9%.

Touch **[AUTOSET Narrow]**. The change is automatic. The new range values appear next to the **[Set Hi]** and **[Set Lo]** control buttons.

Note: The autoset function has no effect if only mean values are displayed.

Carbon Dioxide Site-Scale

Touch the **[Site -Scale]** tab in the CO₂ notebook to display the CO₂ site-scale page.

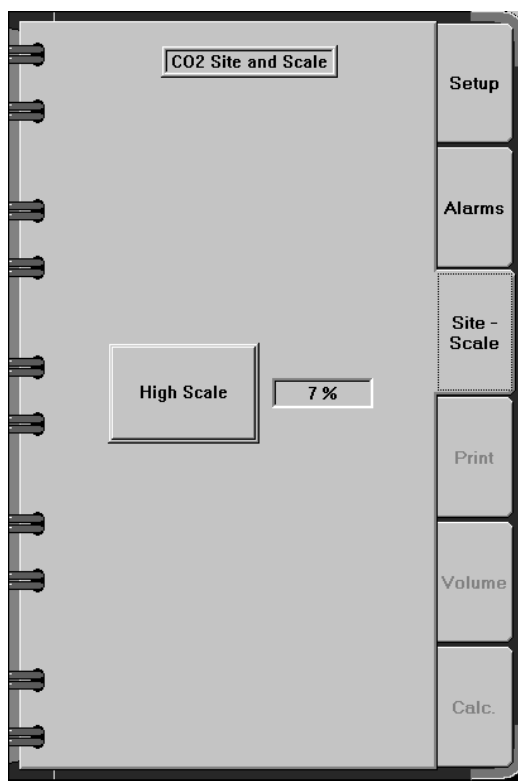


Figure 4-10. CO₂ Monitoring Site-Scale Page

High Scale

This parameter is used to adjust the scale for the CO₂ waveform.

Touch the **[High Scale]** button to toggle between 7% and 10%; between 53 mmHg and 76 mmHg; or between 7 kPa and 10 kPa (depending on the currently selected units of measure.)

Note: Touching the high scale number on the CO₂ waveform also toggles between the two choices for the currently selected units of measure.

Gas Analysis Pod Zero Calibration and Delay

After the initial warm-up diagnostics, the gas analysis systems calibrate automatically, usually no more than once every two hours of continuous operation. During the calibration period, generally 15-30 seconds, the agent/ N_2O and CO_2 waveforms are blank and “Cal in Progress” is displayed in the parameter boxes. The corresponding information in the trend window and data log doesn’t post.

To assure availability of data during a clinically significant period, the clinician may calibrate the gas analysis pod manually beforehand or delay an automatic calibration to a more convenient time.

Manual Calibration

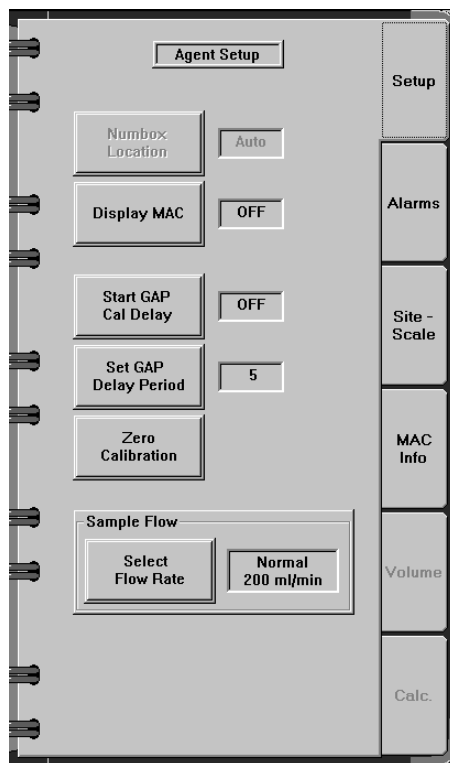


Figure 4-11. Agent Monitoring Setup Page

1. Touch the agent/N₂O or CO₂ parameter box to access an appropriate notebook.
2. Touch the **[Setup]** tab, if necessary.
3. Touch **[Zero Calibration]**.

The zero calibration begins automatically. The readings in the parameter boxes and waveform channels clear, and alarms are turned **OFF**.

When calibration is complete, the Narkomed 6400 automatically resets the parameter box values and waveforms. Alarms are reset to their previously programmed status.

Delayed Calibration

1. Touch the agent/N₂O or CO₂ parameter box to access an appropriate notebook.
2. Touch the **[Setup]** tab, if necessary.
3. Touch **[Set GAP Delay Period]** until the preferred setting is displayed.

The countdown delays can be set from 1 to 10 minutes. The default is 5 minutes.

Note: The gap delay period may also be set to **OFF**.

4. Touch **[Start GAP Cal Delay]**.

While the calibration delay is active (the countdown is going on), the gas analysis system will not calibrate.

Cancel Delayed Calibration

1. Touch **[Set GAP Delay Period]**.
2. Continue touching until the delay period is set to **OFF**.
3. Touch **[Start GAP Cal Delay]**.

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5

Configuration and Settings - Volume, Pressure, and Oxygen

The Narkomed 6400 monitoring system can be configured to meet the specific needs of an individual clinician or hospital for receiving data collected by the volume, pressure, and oxygen (VPO) monitor.

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Default Values

Programmed settings return to their default values after power up or selecting **[New Case]**. A summary of Narkomed 6400 volume, pressure, and oxygen monitoring parameter default settings appears in the following table.

Parameter	Default Value
Oxygen high alarm limit	100%, Autoset Narrow
Oxygen low alarm limit	30%, Autoset Narrow
Minute volume low alarm limit	1.0 liters, Autoset Narrow
Pressure high alarm limit	50 cmH ₂ O, Autoset Narrow
PEEP high alarm limit	6 cmH ₂ O, Autoset Narrow
Pressure threshold	12 cmH ₂ O
Audio alarm silence	120 seconds

Configuring Breathing Pressure Displays

Breathing pressure readings and the waveform appear at the top of the main screen.



Figure 5-1. Monitoring Displays for Breathing Pressure, All Parameters

The parameter box displays peak, mean, plateau, and PEEP pressures. Peak and PEEP pressures are always displayed in the parameter box. Mean and plateau pressures may be selected by the clinician as additional displays. All values are updated with each breath. Numeric data for a breath is posted at the beginning of the subsequent breath's inspiratory pause. Pressure measurements are displayed during apnea conditions as long as the difference between the peak and the PEEP pressure measurements exceeds the pressure breath detection level.



Figure 5-2. Breathing Pressure Parameter Boxes Showing Selected Parameters

Pressure value definitions are as follows:

- PEAK** highest instantaneous pressure value for each breath
- MEAN** average of all of the instantaneous pressure values recorded during each breath
- PLAT** plateau pressure; value measured at the end of inspiration
- PEEP** pressure at the end of exhalation.

These breathing pressure values are displayed if the data is available. If the data is not available (for example, an apnea condition when the peak minus PEEP value is less than 10 cmH₂O), or if the data is out of range, the values will not be displayed.

Note: The system uses the I:E ratio from the ventilator to determine the start and end of a breath. When the ventilator is not in mechanical ventilation mode, the system uses expiratory flow measurements from the flow sensor.

If neither of these signals is present, only peak pressure values will be displayed in the parameter box.

The apnea threshold pressure is indicated on the waveform by a solid line. High and low scale lines mark the waveform channel. The clinician cannot adjust the high or low scale. The high scale updates automatically to 50 or 100 cmH₂O. The default high setting is 50 cmH₂O. The low scale always remains at zero.

Autoscaling the Pressure High Scale

The Narkomed 6400 automatically adjusts the high scale for the pressure waveform according to the following rules.

- If the current high scale is 50 and at the end of the sweep any relative maximum was above the high scale, then the high scale automatically adjusts to 100.

- If the current high scale is 100 and the waveform speed is 12.5 mm/sec, the scale will be adjusted after the number of sweeps specified in the following table. If at the end of the specified number of sweeps all the relative maximums during those sweeps would have fit into the next lower level, then the high scale is automatically adjusted to the lower level (from 100 to 50).

Screen Display	Number of Sweeps Before Autoscaling Down
Main screen	1
Trend displayed	2
Notebook displayed	2
Trend and notebook displayed	4

- If the current high scale is 100 and the waveform speed is 25 mm/sec, the scale will be adjusted after the number of sweeps specified in the following table. If at the end of the specified number of sweeps all the relative maximums during those sweeps would have fit into the next lower level, then the high scale is automatically adjusted to the lower level (from 100 to 50).

Screen Display	Number of Sweeps Before Autoscaling Down
Main screen	2
Trend displayed	4
Notebook displayed	4
Trend and notebook displayed	8

Changing the Apnea Pressure Threshold Limit Line

Press the **[Auto Pressure Thrshld]** command button on the bottom of the main screen to adjust the apnea pressure threshold automatically. (The default setting is 12 cmH₂O.) The clinician can also change the apnea threshold limit by touching, then dragging, the horizontal gray line up or down in the pressure waveform area or by making the correct setting in the pressure parameter notebook. The acceptable range is 5 to 30 cmH₂O.

Threshold Pressure Limit

If a breathing system leak or partial disconnection occurs while the threshold pressure alarm limit is set significantly lower than the peak pressure, continued positive pressure ventilation can produce a pressure fluctuation large enough to exceed the threshold (and thus satisfy the monitor's alarm), yet too small to provide adequate ventilation. See Figure 5-3.

To address this potential condition, the breathing pressure monitor displays the message **Threshold Low** in the pressure parameter box if the current threshold is 4 cmH₂O or more below the optimal threshold position. The optimal threshold position is based on the current breathing pressure peak and PEEP values. See "Threshold Pressure Autoset" on page 5-8 for an explanation of the optimal threshold calculation.

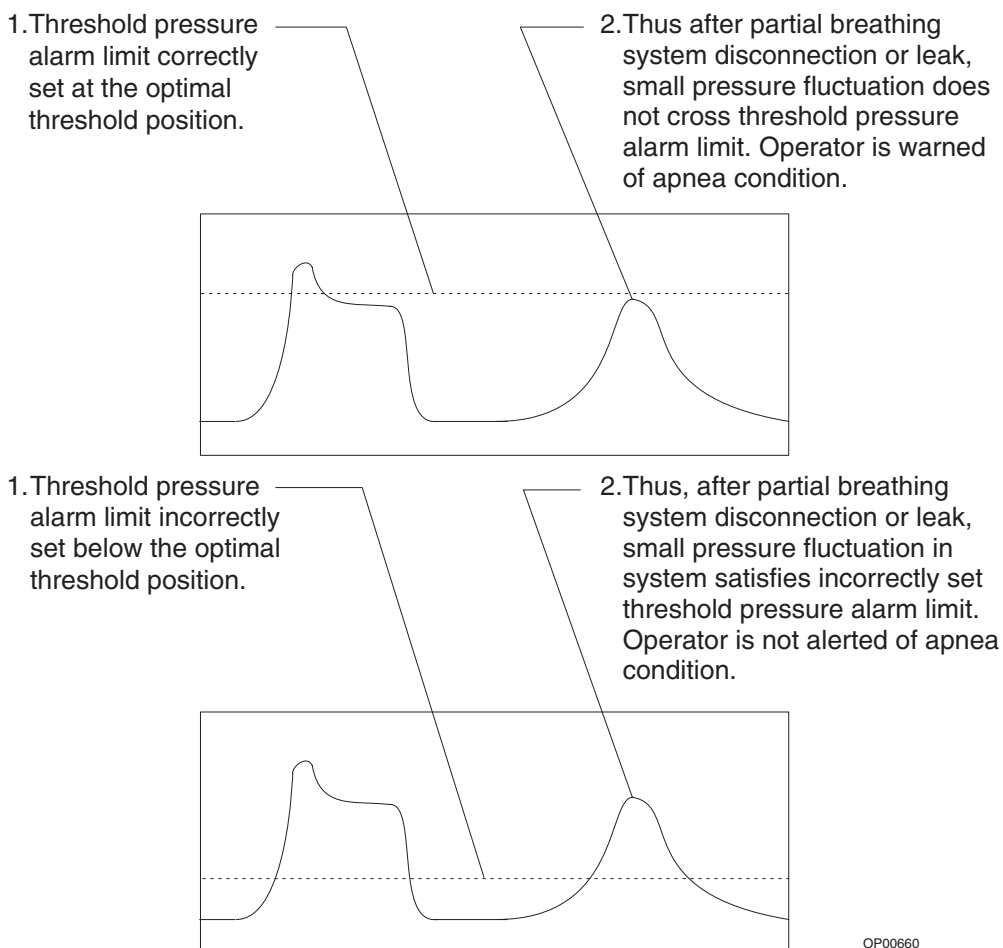


Figure 5-3. Waveforms Produced by Correct or Incorrect Threshold Pressure Limits

**Pressure
Alarm
Annunciation**

When the Narkomed 6400 warms up, the default in **Ventilator Standby** status has alarms silenced (bell has **X** through it). Only the oxygen alarms remain enabled. Both the visual and audible pressure alarms are disabled. When the clinician turns the ventilator on, the pressure alarms are automatically enabled and the alarm bell icon is colored.

The clinician may configure pressure alarm annunciation only when the ventilator is in Manual/Spontaneous Mode. Touch the pressure alarm bell icon until an **X** appears to disable the alarm. Touch the bell again to enable the alarm; the **X** disappears from the display.

Breathing Pressure Settings

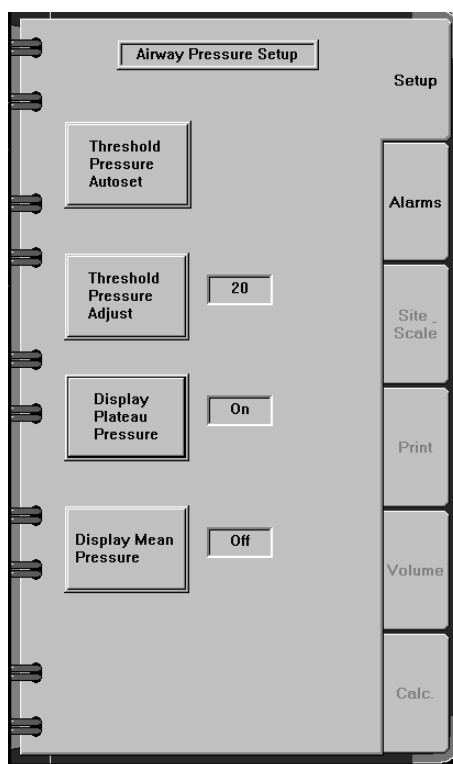
Whenever the Narkomed 6400 is operating, the breathing pressure monitor will measure and display valid breathing pressure data.

Setting Up Pressure Parameters

Touch the pressure parameter box anywhere except the alarm bell to display the pressure notebook.

Pressure Setup

Touch the **[Setup]** tab to display the monitoring setup parameters and programs.



pr_setup.bmp

Figure 5-4. Pressure Monitoring Setup Page

The pressure setup page contains control buttons that perform the following tasks:

- threshold pressure autoset
- threshold pressure adjust
- display plateau pressure
- display mean pressure.

Threshold Pressure Autoset

The clinician may automatically set the pressure apnea threshold at an optimal position by using the autoset control. The optimal position is based on the current breathing pressure peak and PEEP values and is calculated automatically by the breathing pressure monitor. The monitor uses the following calculation to determine the optimal threshold:

$$\text{Autoset Threshold} = 60\% \text{ Peak Pressure} + 40\% \text{ PEEP}$$

To select autoset control for the pressure apnea threshold, touch the **[Threshold Pressure Autoset]** button. The apnea threshold line on the breathing pressure waveform shifts to the optimal threshold position.

Threshold Pressure Adjust

The clinician may also adjust the threshold pressure to a specific setting. Touching and dragging the horizontal line on the screen provides an approximate adjustment. However, for setting a precise threshold pressure for monitoring, use the following procedure.

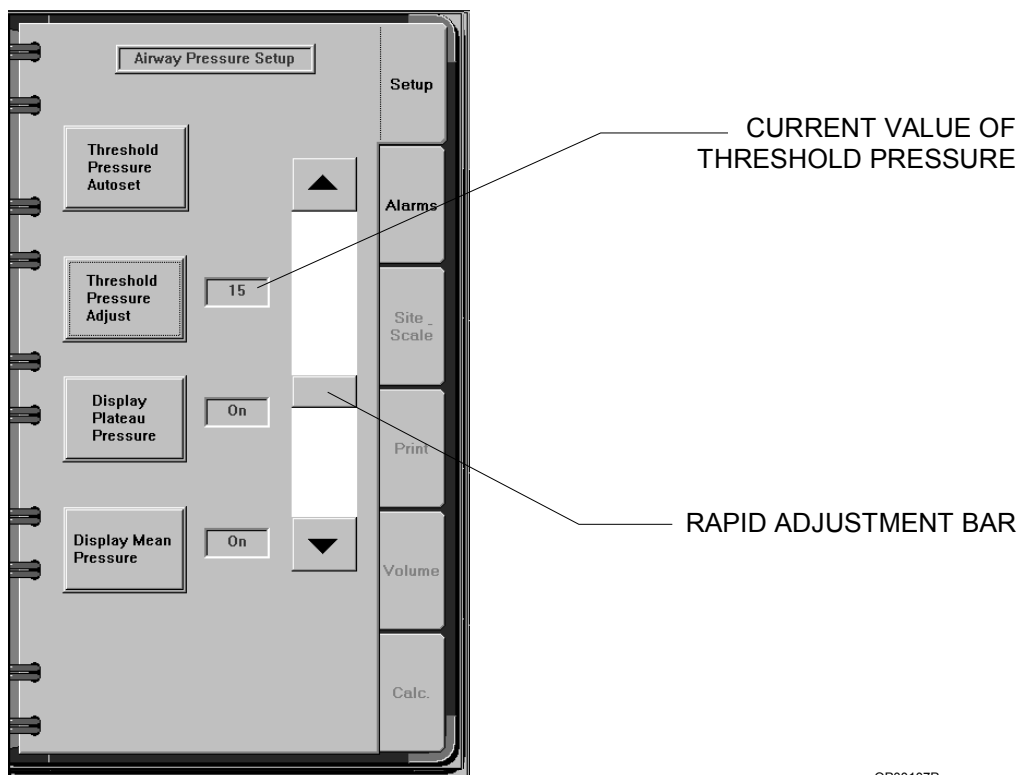


Figure 5-5. Threshold Pressure Adjust Procedure

1. Touch **[Threshold Pressure Adjust]** command button.
A slider bar appears on the setup page.
2. Touch the slider control until the preferred setting is displayed.
 - Use the fine adjustment to change the threshold by 1 cmH₂O
 - Use the coarse adjustment to change the threshold by 2 cmH₂O.

The precise value for threshold pressure appears in the notebook window, and the horizontal line on the screen is reset at the specified level.

Display Plateau Pressure

The clinician may display plateau pressure in the breathing pressure parameter box and in the trend display.

To display plateau pressure, touch the **[Display Plateau Pressure]** setting. The associated window switches from **Off** to **On**. The label **PLAT** appears in the pressure parameter box. A value for plateau pressure is displayed when monitoring begins. To remove the displays, touch the control button again to toggle from **On** to **Off**.

Display Mean Pressure

The clinician may display mean pressure in the breathing pressure parameter box and in the trend display.

To display mean pressure, touch the **[Display Mean Pressure]** setting. The associated window switches from **Off** to **On**. The label **MEAN** appears in the pressure parameter box. A value for mean pressure is displayed when monitoring begins. To remove the displays, touch the control button to toggle from **On** to **Off**.

Pressure Alarms

Touch the **[Alarms]** tab in the pressure notebook to display the alarms page.

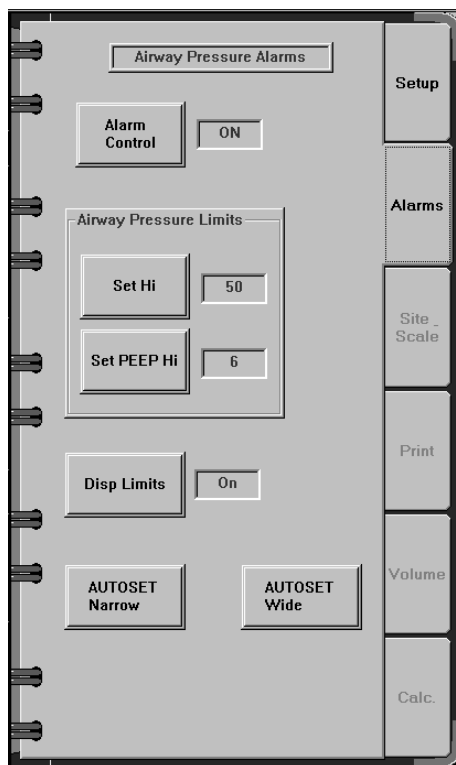


Figure 5-6. Airway Pressure Alarms Page

The pressure alarms page contains control buttons that perform the following tasks:

- alarm control
- set pressure high limit
- set PEEP high limit
- display limits
- autoset narrow or autoset wide.

Pressure Alarm Management

The clinician may turn the pressure alarm notification system on or off by touching the **[Alarm Control]** button until the preferred setting is displayed. The associated window switches from **OFF** to **ON**. To turn the pressure alarm notification system off, touch the control button again to toggle from **On** to **Off**; an **✕** appears on the alarm bell in the pressure parameter box.

When the Narkomed 6400 warms up, the default in **Ventilator Standby** has pressure alarms silenced (bell has **✕** through it). Only the oxygen alarms remain enabled at all times. Both the visual and audible apnea pressure alarms are disabled. When the clinician turns the ventilator on, the apnea alarms are automatically enabled and the alarm bell icon is colored. When the clinician changes to **Ventilator Standby**, the breathing pressure alarm is turned off (bell has **✕** through it), since no ventilation is possible.

Note: The breathing pressure alarms are turned off automatically when the ventilator is placed in Manual/Spontaneous mode.

During spontaneous ventilation, the patient's expiration produces a pressure fluctuation of only a few cmH₂O. To prevent false apnea alarms, the breathing pressure apnea alarm is disabled.

During the disabled period, the alarm bell has an **✕** through it. Touch the alarm bell icon to enable the apnea alarm.

Note: The breathing pressure alarms are turned on automatically when the ventilator is in any automatic ventilation mode. They cannot be turned off unless the ventilator is placed in Manual/Spontaneous mode.

When the ventilator is set to Pressure, Volume, or SIMV Mode, the apnea alarm is automatically enabled, even if the apnea alarm was previously disabled. When in one of these automatic ventilation modes, pressing **[Alarm Suspend]** will not disable the breathing pressure alarms.

Breathing pressure alarms are automatically enabled when a ventilator safe state condition is detected (**VENT FAIL** alarm active).

Setting Pressure High Alarm Limit

This parameter sets the high alarm limits for pressure. The range of available settings is 10 to 100 cmH₂O. The default setting is 50 cmH₂O.

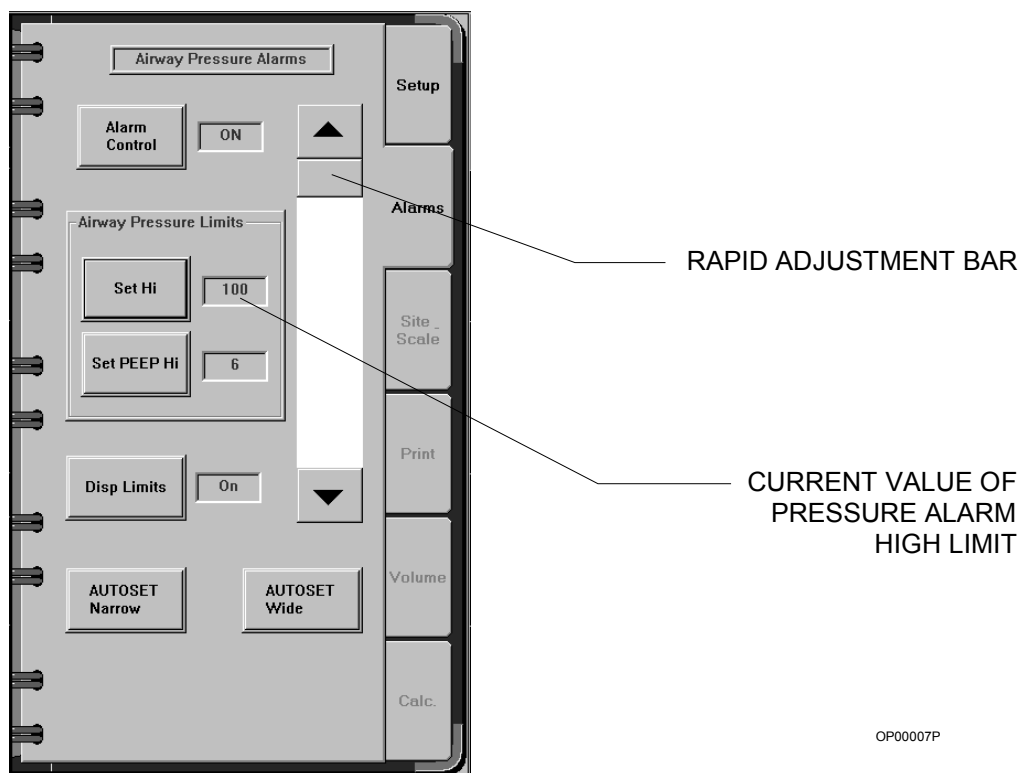


Figure 5-7. Pressure High Alarm Limit Adjustment Procedure

1. Touch **[Set Hi]** to activate the adjustment at the **[Airway Pressure Limits]** setting.

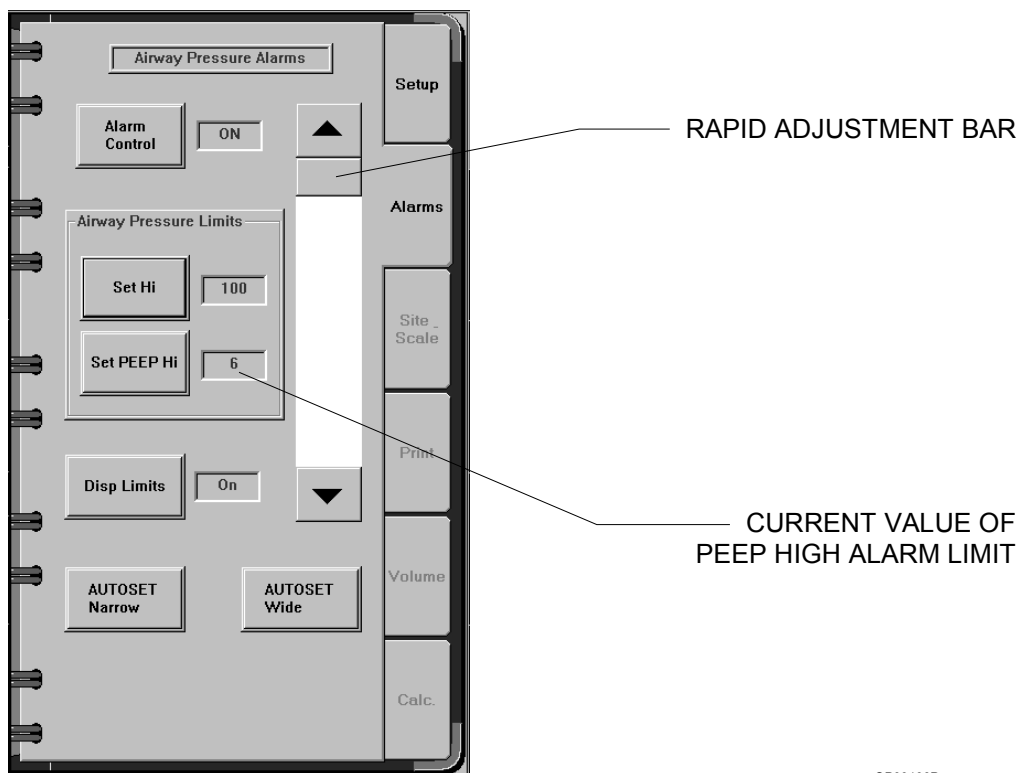
A slider bar appears on the alarms page.

2. Touch the slider control until the preferred setting is displayed.
 - Use the fine adjustment to change the setting by 1 cmH₂O.
 - Use the coarse adjustment to change the setting by 10 cmH₂O.

The precise value for the pressure alarm limit appears in the notebook window next to the **[Set Hi]** button.

Setting PEEP High Alarm Limit

This parameter sets the high alarm limits for PEEP. The range of available settings is 0 to 20 cmH₂O. The default setting is 6 cmH₂O.



OP00106P

Figure 5-8. PEEP High Alarm Limit Adjustment Procedure

1. Touch **[Set PEEP Hi]** to activate the adjustment at the **[Airway Pressure Limits]** setting.

A slider bar appears on the alarms page.

2. Touch the slider control until the preferred setting is displayed.
 - Use the fine adjustment to change the setting by 1 cmH₂O.
 - Use the coarse adjustment to change the setting by 2 cmH₂O.

The precise value for the PEEP alarm limit appears in the notebook window next to the **[Set PEEP Hi]** button.

Display Pressure Limits

The clinician may display alarm limits in the pressure parameter box by touching the **[Disp Limits]** button until the preferred selection is displayed.

The associated window displays alarm limits for pressure and PEEP on the right side of the parameter box. To turn the alarm limits display off, touch the control button again to toggle from **On** to **Off**.

AUTOSET Narrow Pressure Alarm Limits

The autoset narrow function affects both the pressure and PEEP alarm limits.

The clinician may set the high pressure alarm limit to 5 cmH₂O more than the current peak pressure measurement, but not more than 100 cmH₂O.

The clinician may set the high PEEP alarm limit to 3 cmH₂O more than the current PEEP measurement, but not more than 20 cmH₂O.

Touch **[AUTOSET Narrow]**. The change is automatic. The new range values appear next to the **[Set Hi]** and **[Set PEEP Hi]** control buttons.

AUTOSET Wide Pressure Alarm Limits

The autoset wide function affects both the pressure and PEEP alarm limits.

The clinician may set the high pressure alarm limit to 10 cmH₂O more than the current peak pressure measurement, but not more than 100 cmH₂O.

The clinician may set the high PEEP alarm limit to 6 cmH₂O more than the current PEEP measurement, but not more than 20 cmH₂O.

Touch **[AUTOSET Wide]**. The change is automatic. The new range values appear next to the **[Set Hi]** and **[Set PEEP Hi]** control buttons.

Configuring Respiratory Volume Displays

The Narkomed 6400 monitors respiratory volume using the flow sensor. The assembly has two transducers that measure the time of flight of ultrasonic pulses transmitted upstream and downstream in the airway flow path. The difference in time of flight is used to determine the velocity and the flow rate of gas through the patient circuit.

Numerical and graphical spirometry data, calculated from expiratory flow, appear as the second waveform from the top and in the volume parameter box on the main screen.

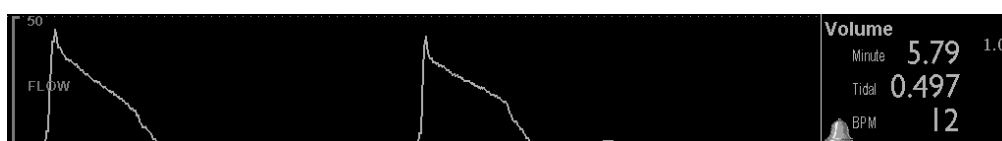


Figure 5-9. Monitoring Displays for Respiratory Volume and Flow

The volume parameter box displays minute and tidal volumes and respiratory rate in breaths per minute (BPM) calculated from flow sensor information. The expiratory flow waveform provides a means for a quick visual assessment of lung mechanics and ventilation and for checking the expiratory flow pathway.

Autoscaling the Waveform High Scale

The Narkomed 6400 automatically adjusts the high scale for the flow waveform according to the following rules.

- If the current high scale is either 20 or 50 and at the end of the sweep any relative maximum was above the high scale, then the high scale automatically adjusts to the next higher level (from 20 to 50 and from 50 to 100).
- If the current high scale is 50 or 100 and the waveform speed is 12.5 mm/sec, the scale will be adjusted after the number of sweeps specified in the following table. If at the end of the specified number of sweeps all the relative maximums during those sweeps would have fit into the next lower level, then the high scale is automatically adjusted to the lower level (from 100 to 50 and from 50 to 20).

Screen Display	Number of Sweeps Before Autoscaling Down
Main screen	1
Trend displayed	2
Notebook displayed	2
Trend and notebook displayed	4

- If the current high scale is 50 or 100 and the waveform speed is 25 mm/sec, the scale will be adjusted after the number of sweeps specified in the following table. If at the end of the specified number of sweeps all the relative maximums during those sweeps would have fit into the next lower level, then the high scale is automatically adjusted to the lower level (from 100 to 50 and from 50 to 20).

Screen Display	Number of Sweeps Before Autoscaling Down
Main screen	2
Trend displayed	4
Notebook displayed	4
Trend and notebook displayed	8

Tidal Volume

The tidal volume display indicates the tidal volume for each breath. If a volume apnea condition occurs, the tidal volume numeric in the parameter box is blank. Tidal volume is updated once every breath. The tidal volume display ranges from 2 mL to 9.99 liters. The displayed value is corrected for hose compliance and for volume taken away by the gas analysis pump by the Narkomed 6400 processor.

Minute Volume

The minute volume display continuously indicates the total volume of exhaled gas accumulated during a minute of respiration. Minute volume is updated once every breath. The minute volume display ranges from 0.02 to 99.9 liters.

Respiratory Rate

The respiratory rate display indicates the total number of breaths (BPM) registered by the monitor during a minute of respiratory activity. Respiration rate display ranges from 2 to 99 BPM. If data is not available, the values are removed from the screen.

Volume Alarm Annunciation

To enable the minute volume and apnea-volume alarms, touch the volume alarm bell icon. To disable the alarms, touch the volume alarm bell icon until an **X** appears. The low minute volume alarm limit is adjusted in the volume notebook.

When the Narkomed 6400 warms up, the default in **Ventilator Standby** status has alarms silenced (bell has **X** through it). Only the oxygen alarms remain enabled at all times. Both the visual and audible respiratory volume alarms are disabled. When the clinician turns the ventilator on, the volume alarms are automatically enabled and the alarm bell icon is colored. Once the alarms are on, they can be set to **OFF** or **STANDBY** only by touching the volume alarm bell icon or **[Alarm Control]** in the volume notebook.

To ensure that the volume alarms are active during automatic ventilation, the volume alarms disable function is tied into the ventilator mode control. When the ventilator is set to Volume, Pressure, SIMV, or Manual/Spontaneous Mode, the volume alarms are automatically enabled.

The volume alarms can be manually disabled by touching the volume alarm bell icon. While alarms are disabled, the alarm bell icon with ✕ through it appears in the parameter box.

Respiratory Volume Settings

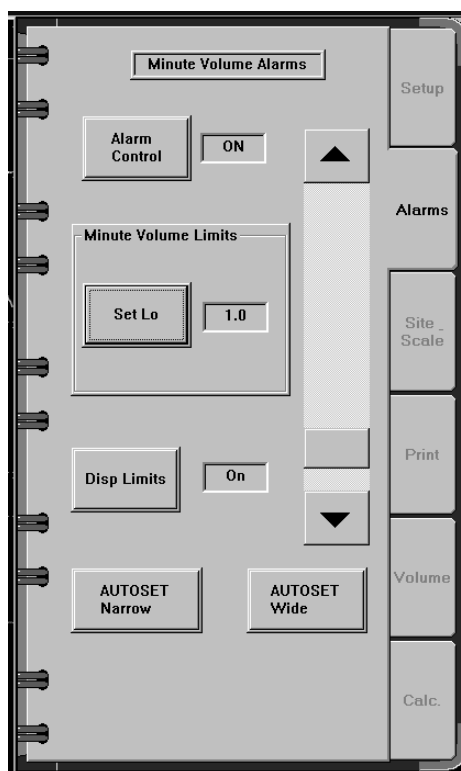
Set the appropriate parameters for monitoring respiratory volume in the volume notebook.

Setting Up Volume Parameters

Touch the volume parameter box anywhere except the alarm bell to display the volume notebook.

Minute Volume Alarms

The alarms page is the only page currently available in the volume notebook.



vol_alarm.bmp

Figure 5-10. Minute Volume Alarms Page

Volume Alarm Management

The clinician may turn the respiratory volume alarm notification system on or off by touching the **[Alarm Control]** button until the preferred setting is displayed:

ON turns the respiratory volume alarm notification system on

OFF turns the respiratory volume alarm notification system off; an **X** appears on the alarm bell in the volume parameter box

STBY turns the respiratory volume alarm notification system to **Alarm Standby**. If valid data is detected by the system, the volume alarm management will automatically change to **ON**.

Setting Low Minute Volume Alarm Limits

This parameter sets the alarm limits for minute volume readings. The range of available settings is 0.2 to 10.0 liters. The default setting is 1.0 liter.

1. Touch **[Set Lo]** to activate the slider bar at the **[Minute Volume Limits]** setting.
2. Move the slider control until the preferred setting is displayed next to the **[Set Lo]** control button.
 - Use the fine adjustment to change the setting by 0.1 liter.
 - Use the coarse adjustment to change the setting by 1.0 liter.

Display Volume Limits

The clinician may display the respiratory volume alarm limits by touching the **[Disp Limits]** button until the preferred setting is displayed:

On displays the alarm limits on the upper right side of the parameter box

Off does not display the alarm limits.

AUTOSET Narrow Minute Volume Alarm Limits

The clinician may set the alarm limits 0.5 liter less than the current minute volume reading, but not less than 0.2 liter.

Touch **[AUTOSET Narrow]**. The change is automatic. The new value appears next to the **[Set Lo]** control button.

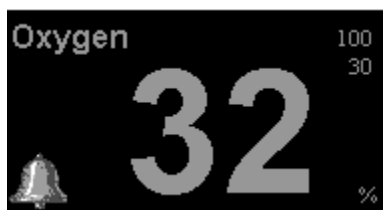
AUTOSET Wide Minute Volume Alarm Limits

The clinician may set the alarm limits 1.0 liter less than the current minute volume reading, but not less than 0.2 liter.

Touch **[AUTOSET Wide]**. The change is automatic. The new value appears next to the **[Set Lo]** control button.

Configuring Oxygen Displays

The oxygen parameter box at the bottom of the main screen displays the inspiratory concentration of oxygen. There is no waveform associated with this display.



o2_param.bmp

Figure 5-11. Monitoring Displays for Oxygen

The parameter box displays the percentage of oxygen concentration. The display range is 10% to 100%.

Oxygen Settings

Calibrating the Oxygen Monitoring System

To calibrate the oxygen monitoring system correctly, the oxygen sensor must be exposed to room air. Calibration should be performed as part of the daily, preoperative setup of the anesthesia equipment.

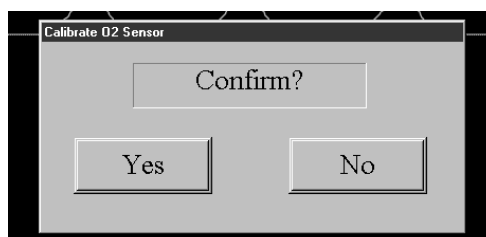
Oxygen Sensor Preparation

1. Remove the sensor assembly from the inspiratory valve dome and plug the dome with the inspiratory valve dome plug. (Do not disassemble the sensor assembly further.)
2. Expose the sensor to ambient air only (away from any open part of the breathing system), and allow it to stabilize for several minutes. The sensor should only be exposed to the 21% oxygen concentration normally found in ambient air.

Monitoring System Calibration

3. Touch the **[O2 Cal]** command button on the main touch screen.

A calibration dialog box for the oxygen sensor appears on the main screen.



o2cal_bx.bmp

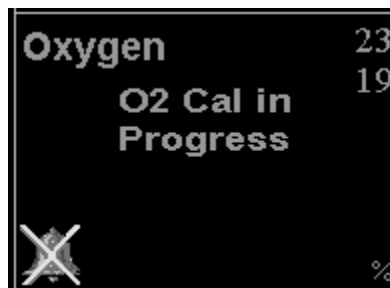
Figure 5-12. Oxygen Sensor Calibration Dialog Box

Note: An alternative procedure is to initiate calibration from the oxygen parameter notebook. See “Oxygen Setup” on page 22 of this section.

Note: The **[O2 Cal]** button is disabled when the oxygen zero calibration values are invalid.

4. Touch **[Yes]** to confirm the calibration.

The oxygen value on the display disappears. The message **O2 Cal in Progress** is displayed in the oxygen parameter box during the calibration process, and oxygen alarms are turned **OFF**.



o2cal_on.bmp

Figure 5-13. Oxygen Parameter Box Showing Oxygen Calibration in Process

The length of time that the sensor takes to calibrate depends on the gas mixture which the sensor was exposed to before calibration.

Note: If the sensor was exposed to 21% oxygen for longer than one minute, prior to calibration, the calibration can take as little as 10 seconds. If the sensor was exposed to higher concentrations of oxygen prior to calibration, the calibration may last up to 50 seconds. Typically, calibration lasts less than 30 seconds.

When the calibration is complete, the ambient air oxygen concentration appears on the display and the alarm is automatically enabled.

5. Pull the inspiratory valve dome plug and reinsert the sensor assembly.

If, at the end of the calibration period, the oxygen parameter box remains blank, the calibration was not successful. (This condition is also indicated by the advisory message **O2 CAL ERROR**. The **O2 CAL DUE** advisory remains posted.)

An unsuccessful calibration can be caused by any of the following conditions:

Cause of Unsuccessful Calibration	Remedy
Oxygen sensor exposed to an excessively lean or rich oxygen mixture	Make sure that the sensor is exposed only to room air for the entire calibration period.
Oxygen sensor exposed to a constantly changing mixture	As above, make sure that the sensor is exposed only to room air for the entire calibration period.
Oxygen sensor has not received the proper waiting period	When the sensor capsule is removed from the sensor assembly, a waiting period equal to the time that the capsule spent outside the sensor assembly (up to one week) is necessary. New sensors require a 15-minute waiting period.
Exhausted oxygen sensor	If the oxygen sensor has decayed beyond its useful service life, replace the decayed sensor with a new sensor and allow the proper waiting period.
Defective oxygen sensor	If the sensor contains too great a difference between the outputs of the two sensor halves, replace it with a new sensor and allow the proper waiting period.
Disconnected oxygen sensor	If the sensor is disconnected, the parameter box is blank and the message O2 SENSOR DISC will appear on the alarm display. When this happens, reconnect the sensor cord to the interface panel on the Narkomed 6400 and recalibrate the sensor.

During normal operation, the Narkomed 6400 will sense that a calibration procedure is required after every 18 hours of continuous use and advise the clinician to calibrate the oxygen monitoring system as soon as it is convenient.

If the oxygen monitoring system is improperly calibrated, its measurements may not be accurate. When a calibration gas mixture is excessively rich or lean in oxygen, the Narkomed 6400 will not complete an attempted calibration; however, if the calibration gas is rich or lean but is within certain limits, the Narkomed 6400 will complete the calibration. As a result, when displaying sensor measurements, the Narkomed 6400 displays an oxygen percentage either greater or less than the actual oxygen percentage. Therefore, make sure the sensor is exposed only to room air during the entire calibration period.

The following graph illustrates the relationship between the calibration mixture and the accuracy of oxygen measurement.

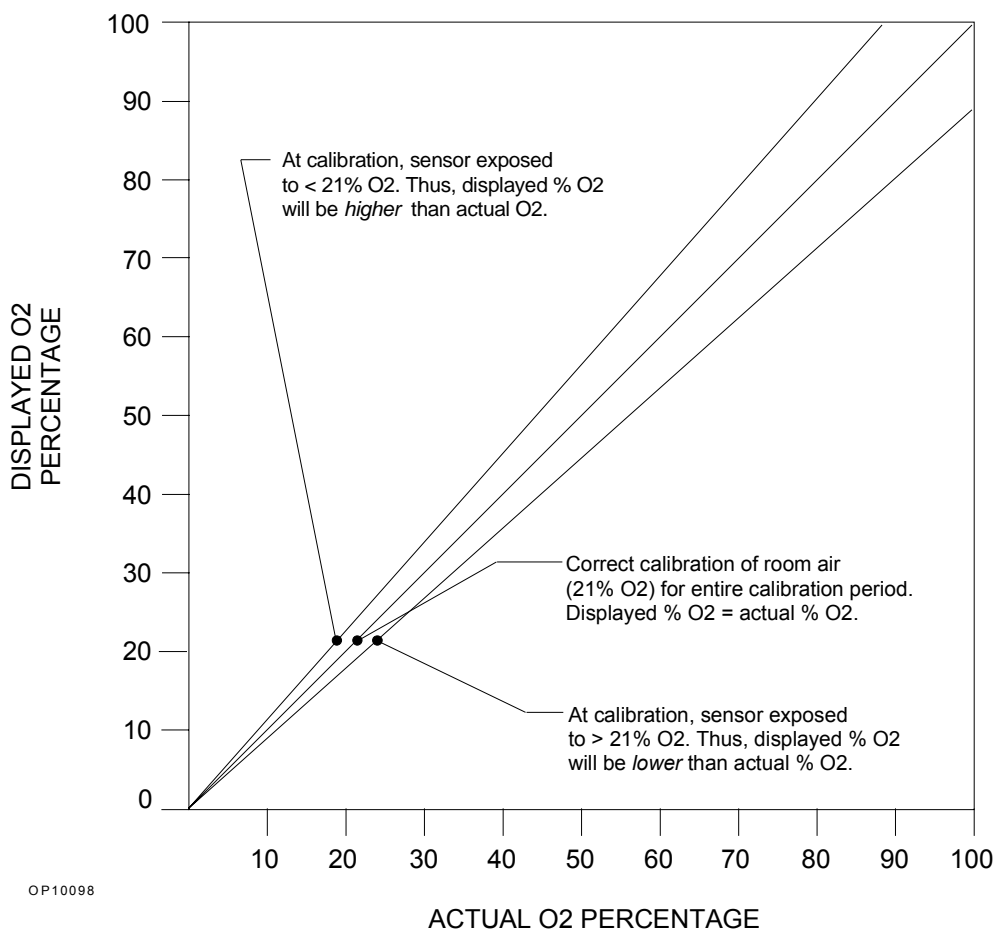


Figure 5-14. Relationship Between Calibration and Precise Delivery of Oxygen

5

Configuration and Settings - Volume, Pressure, and Oxygen

Setting Up Oxygen Parameters

Touch the oxygen parameter box anywhere except the alarm bell to display the oxygen notebook.

Oxygen Setup

Touch the **[Setup]** tab to display the monitoring setup parameters and programs.

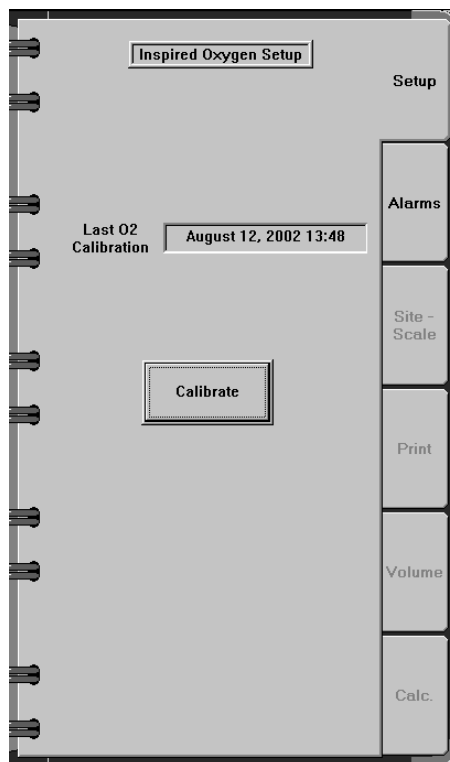


Figure 5-15. Oxygen Monitoring Setup Page

Last O₂ Calibration

This field displays the date and time of the last oxygen monitoring system calibration. This information is maintained in the system even if the Narkomed 6400 is powered off.

Note: The system monitors the time since the last oxygen monitoring system calibration. An advisory message is displayed in the alarm window if more than 18 hours has passed since the last successful calibration.

Calibrate

The clinician may initiate the calibration process for the oxygen monitoring system from the oxygen notebook. An alternative is to initiate calibration from the main screen. See “Calibrating the Oxygen Monitoring System” on page 18, above.

1. Remove the sensor assembly from the inspiratory valve dome and plug the dome with the inspiratory valve dome plug. (Do not disassemble the sensor assembly further.)
2. Expose the sensor to ambient air only (away from any open part of the breathing system), and allow it to stabilize for several minutes. The sensor should only be exposed to the 21% oxygen concentration normally found in ambient air.
3. Touch **[Calibrate]**.

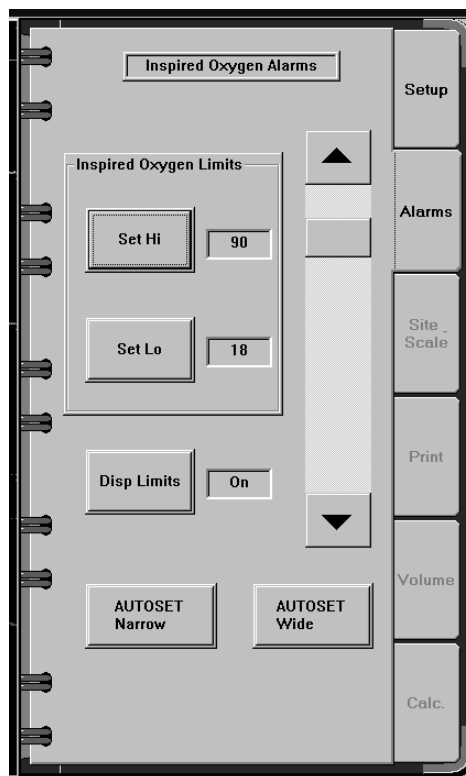
O2 Cal in Progress appears in the oxygen parameter box until the calibration is complete. Then the current reading is redisplayed.

Note: No confirmation by the clinician is required when initiating a calibration from the notebook; a dialog box does not appear.

Note: The **[Calibrate]** button is disabled when the oxygen zero calibration values are invalid.

Oxygen Alarms

Touch the **[Alarms]** tab in the oxygen notebook to display the alarms page.



o2_alarm.bmp

Figure 5-16. Oxygen Alarms Page

Oxygen Alarm Management

The clinician cannot disable oxygen alarms. This is a safety feature whereby the alarms are activated whenever the O₂ sensor is plugged in and calibrated and de-activated whenever the O₂ sensor is disconnected. The alarms cannot be accidentally turned off.

Setting High Alarm Limits for Inspired Oxygen

This parameter sets the high alarm limits for inspired oxygen. The range of available settings is 19% to 100% concentration. The factory default setting is 100%. The high alarm limit cannot be set to a value less than or equal to the current low alarm limit.

1. Touch **[Set Hi]** to activate the slider bar at the **[Inspired Oxygen Limits]** setting.
2. Move the slider control until the preferred setting is displayed next to the **[Set Hi]** control button.
 - Use the fine adjustment to change the alarm limit by 1%
 - Use the coarse adjustment to change the alarm limit by 10%.

Setting Low Alarm Limits for Inspired Oxygen

This parameter sets the low alarm limits for inspiratory measurement. The range of available settings is 18% to 99% concentration. The factory default setting is 30%. The low alarm limit cannot be set to a value greater than or equal to the high alarm limit.

1. Touch **[Set Lo]** to activate the slider bar.
2. Move the slider control until the preferred setting is displayed next to the **[Set Lo]** control button.
 - Use the fine adjustment to change the alarm limit by 1%
 - Use the coarse adjustment to change the alarm limit by 10%.

Display Oxygen Limits

The clinician may display alarm limits in the oxygen parameter box. Touch **[Disp Limits]** until the preferred selection is displayed.

The associated window displays alarm limits on the upper right side of the parameter box. To turn the oxygen alarm limits display off, touch the control button again to toggle from **On** to **Off**.

AUTOSET Narrow

The clinician may set the alarm limits to $\pm 2\%$ more than the current oxygen concentration measurement, but not less than 18% nor more than 100%.

Touch **[AUTOSET Narrow]**. The change is automatic. The new range values appear next to the **[Set Hi]** and **[Set Lo]** control buttons.

AUTOSET Wide

The clinician may set the alarm limits to $\pm 5\%$ more than the current oxygen concentration measurement, but not less than 18% nor more than 100%.

Touch **[AUTOSET Wide]**. The change is automatic. The new range values appear next to the **[Set Hi]** and **[Set Lo]** control buttons.

6

Configuration and Settings - Ventilator

The Divan ventilator is independently configured to provide highly-controlled settings for mechanical breathing. These settings may also appear on the monitor in the form of real-time data.

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Default Values

The ventilator is shipped with the following factory-set default parameter settings for mechanical ventilation modes.

Button	Parameter	Default Setting
[Pmax/Pset]	Maximum ventilation pressure (Pmax) provided by the ventilator in Volume and SIMV modes	30 cmH ₂ O
[Pmax/Pset]	Peak airway pressure (Pset) provided by the ventilator in Pressure mode	10 cmH ₂ O
[Vt]	Tidal volume in Volume and SIMV modes	600 mL
[Rate]	Breathing rate (except in SIMV mode)	12 bpm
[I:E]	Inspiratory:Expiratory Ratio	1:2.0
[% I.P./Flow]	Ratio of inspiratory pause time/inspiration time (%IP) in Volume and SIMV modes	10%
[% I.P./Flow]	inspiratory flow rate (Flow) in Pressure mode	50L/min
[PEEP]	Positive end-expiratory pressure	0 cmH ₂ O
[SIMV Rate]	Breathing rate in SIMV mode	12 bpm

The default settings can be changed by an authorized representative of DrägerService, if requested.

Adjusting Ventilator Parameters

Ventilator parameters with a single-function button can be adjusted at any time before or during the case except when the ventilator is performing an automated test. Single-function parameter buttons include: Vt, Rate, I:E, PEEP, and SIMV Rate.

Ventilator parameters controlled by dual-function buttons can be adjusted when the ventilator status is appropriate:

- Pmax and % I.P. can be adjusted any time the ventilator is in **Ventilator Standby** status, Manual/Spontaneous mode, Volume mode, SIMV mode, or when Volume or SIMV mode has been prompted but not confirmed (mode button LED flashing).
- Pset and Flow can be adjusted any time the ventilator is in Pressure mode, or when Pressure mode has been prompted but not confirmed (Pressure mode button LED flashing).

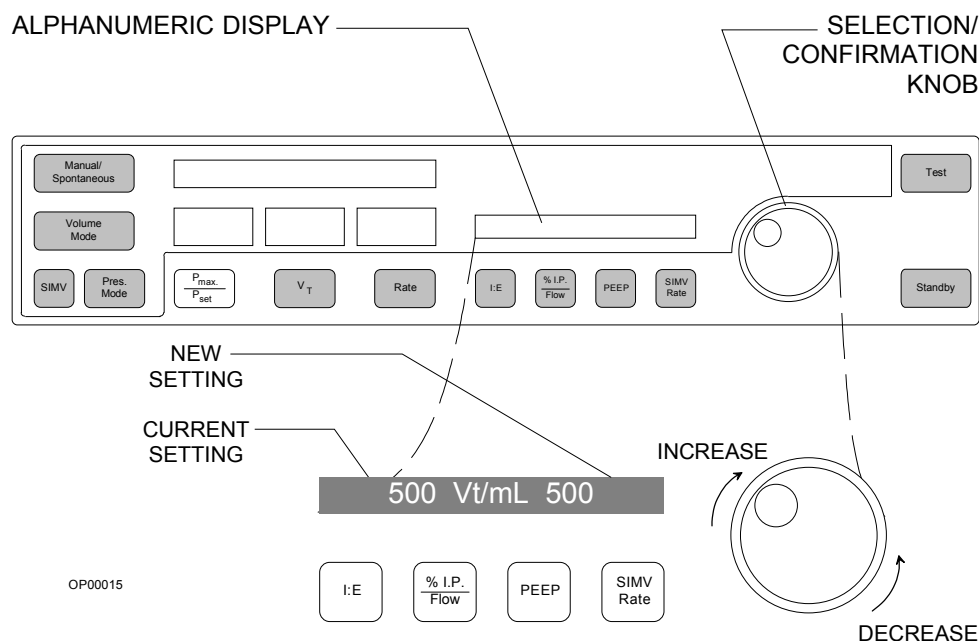


Figure 6-1. Adjusting Parameters on Ventilator

1. Press a parameter setting button. (For example, press the **[Vt]** button.)
2. Note that the current setting, the parameter and its unit of measure, and the adjusted value appear in the alphanumeric display in sequential order.

3. Turn the selector knob until the desired setting is displayed on the right side of the display.
 - Turning the selector knob clockwise increases the setting.
 - Turning the selector knob counterclockwise decreases the setting.
4. Press the selector knob to confirm the change.

Note: The range of settings may be limited by certain constraints. These limitations are listed below for specific ventilator parameters.

Pmax/Pset Set the maximum allowable breathing pressure.

Limitations on Ventilator Pmax Settings

Pmax cannot be set to values resulting in the following conditions:

- $P_{max} > 80 \text{ cmH}_2\text{O}$
- $P_{max} < 10 \text{ cmH}_2\text{O}$
- $P_{max} < PEEP + 5 \text{ cmH}_2\text{O}$

Limitations on Ventilator Pset Settings

Pset cannot be set to values resulting in the following conditions:

- $P_{set} > 70 \text{ cmH}_2\text{O}$
- $P_{set} < 10 \text{ cmH}_2\text{O}$
- $P_{set} < PEEP + 5 \text{ cmH}_2\text{O}$

Pset with
Inspiratory
Flow
Limitation

During Pressure Mode ventilation, Pset may not be achieved if inspiratory flow rate is too low for current Rate, I:E ratio, and patient conditions. Check for the **Raise Insp. flow** message on the control panel display.

**Tidal Volume
(Vt)**

Set the desired volume per breath.

Limitations on Ventilator Tidal Volume Settings

Tidal volume cannot be set to values resulting in the following conditions:

- tidal volume $> 1400 \text{ mL}$
- tidal volume $< 10 \text{ mL}$
- inspiratory flow $> 75 \text{ L/min}$
- minute volume $> 25 \text{ L/min}$.

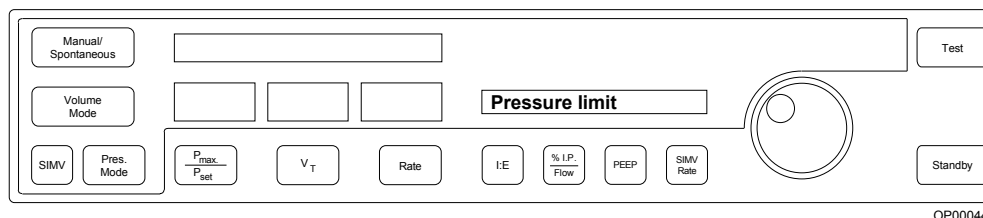


Figure 6-2. Verifying Tidal Volume

Tidal Volume with Pressure Limitation (Pmax)

During Volume or SIMV mode ventilation, if the maximum allowable breathing pressure (Pmax) is reached, inspiratory flow is stopped; therefore, the set tidal volume may not be fully delivered.

1. Check for the **Pressure limit** message on the control panel display.
2. The bar graph on the ventilator will not reach 100% when tidal volume is limited.
3. If the pressure increases by more than 5 cmH₂O above Pmax, for example because the patient coughs, inspiration is immediately stopped and expiration starts.

Breathing Rate (Rate)

Set the number of breaths per minute.

Limitations on Frequency Settings

Frequency cannot be set to values resulting in any of the following conditions:

- Rate > 80 bpm
- Rate < 6 bpm
- inspiratory flow > 75 L/min
- minute volume > 25 L/min
- in Pressure mode the breath rate is limited so as not to exceed 25L minute volume, based on the last preset tidal volume, or 75 L/min inspiratory flow at the last preset % Insp Pause and Vt

Note: The tidal volume setting may need to be lowered to achieve the desired rate while in Pressure mode.

- expiratory time < 400 milliseconds.

I:E Ratio

Set the ratio of inspiration to expiration.

Limitations on I:E Settings

I:E ratio cannot be set to values resulting in any of the following conditions:

- I:E > 5:1
- I:E < 1:5
- inspiratory flow > 75 L/min
- expiratory time < 400 milliseconds.

Entering an Inverse I:E

A dialog box appears on the main screen after a clinician confirms an inverse I:E ratio setting on the ventilator control panel. The dialog box notifies the clinician about an inverse I:E ratio setting and provides a selection button to remove the notification. Further confirmation of the inverse ratio is not needed. If the clinician resets the I:E ratio to a normal ratio (not inverse), the box disappears from the screen.

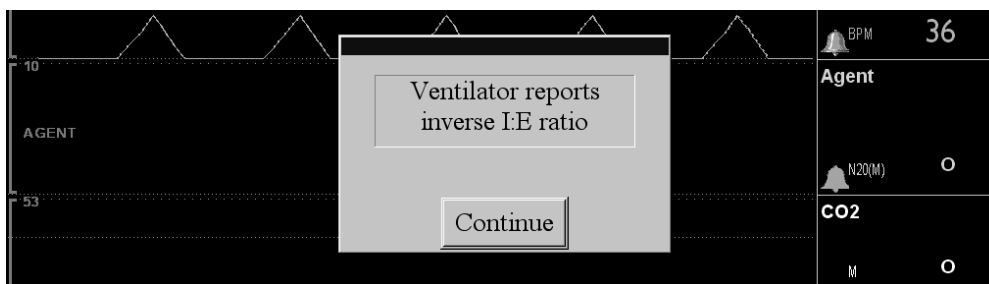


Figure 6-3. Inverse I:E Dialog Box

% Inspiratory Pause/Flow

Set the inspiratory pause in Volume and SIMV modes or the inspiratory flow rate in Pressure mode.

Limitations on % Inspiratory Pause Settings

% I.P. cannot be set to values resulting in the following conditions:

- % I.P. > 60%
- % I.P. < 0%
- inspiratory flow > 75 L/min.

Limitations on Inspiratory Flow Settings

Inspiratory flow cannot be set to values resulting in the following conditions:

- inspiratory flow > 75 L/min
- inspiratory flow < 5 L/min

PEEP

Set the desired positive end expiratory pressure.

Limitations on Ventilator PEEP Settings

PEEP cannot be set to values resulting in the following conditions:

- PEEP > 20 cmH₂O
- PEEP < 0 cmH₂O
- PEEP > P_{max} - 5 cmH₂O
- PEEP > P_{set} - 5 cmH₂O

PEEP can be set in SIMV or Manual/Spontaneous mode, but the setting will not take effect until the ventilator is set to either Volume or Pressure mode. When the clinician sets the PEEP in SIMV or Manual/Spontaneous mode, the following dialog box appears on the screen. Pressing the **[OK]** button removes the dialog box.

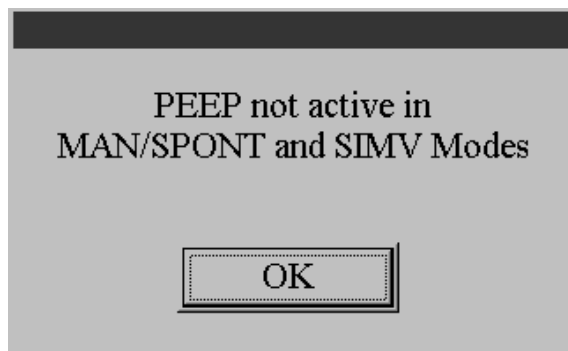


Figure 6-4. PEEP Not Active Dialog Box

SIMV Rate

Set the minimum number of breaths per minute in SIMV mode.

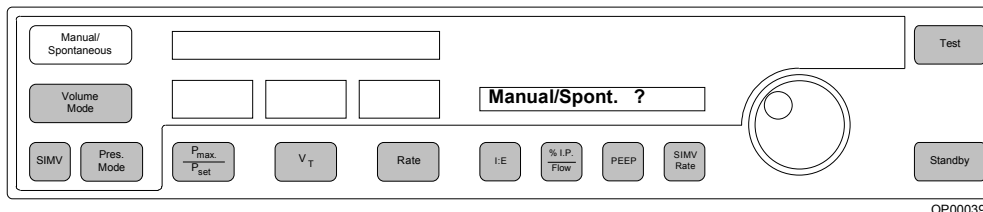
Limitations on SIMV Rate Settings

SIMV Rate cannot be set to values resulting in the following conditions:

- SIMV Rate > 80 bpm
- SIMV Rate < 3 bpm
- SIMV Rate > Rate

Selecting Operating Mode

Spontaneous Breathing



OP00039

Figure 6-5. Selecting Ventilator Spontaneous Breathing Mode

1. Press the **[Manual/Spontaneous]** ventilation mode button.
2. **Manual/Spont. ?** will be displayed
3. Press the selector knob to confirm.
4. **Manual/Spont.** will be displayed.
5.
 - if your Narkomed 6400 is equipped with the knob-style APL valve, rotate the APL valve adjustment knob fully counterclockwise to **Spont** position (the index mark on the knob lines up with the index mark on the bottom of the APL valve).
 - if your Narkomed 6400 is equipped with the toggle-style APL valve, set the toggle on the APL valve to **SPONT** position.
6. Set the appropriate fresh gas flow on the Narkomed 6400.

Note: Adjusting parameter button settings has no effect on ventilation during spontaneous breathing.

Manual Ventilation

1. Press the **[Manual/Spontaneous]** ventilation mode button.
- Note:** In Manual/Spontaneous mode the apnea (pressure and volume) timer countdown for caution alarms changes from 15 seconds to 30 seconds and for warning alarms from 30 seconds to 60 seconds.
2. **Manual/Spont. ?** will be displayed
 3. Press the selector knob to confirm.
 4. **Manual/Spont.** will be displayed.
 5.
 - if your Narkomed 6400 is equipped with the knob-style APL valve, rotate the APL valve adjustment knob to set the appropriate value for the maximum ventilation pressure.
 - if your Narkomed 6400 is equipped with the toggle-style APL valve, set the APL valve to **MAN** position, and adjust the valve to set the appropriate value for the maximum ventilation pressure

6. Press the O₂ flush button on the Narkomed 6400, as required, to inflate the bag.
7. Set the fresh gas flow on the Narkomed 6400.
8. Start manual ventilation.

Note: Adjusting parameter button settings has no effect on ventilation during manual ventilation.

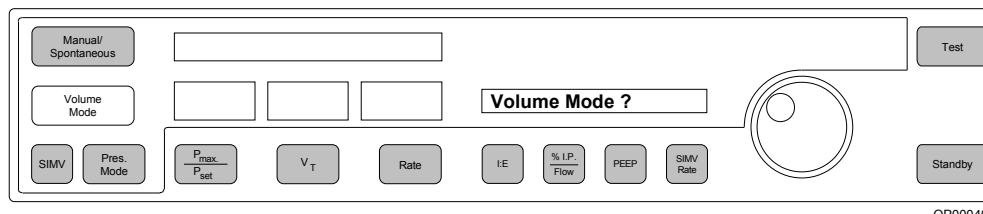
Mechanical Ventilation

Before selecting a mechanical ventilation mode, the clinician must select the appropriate ventilation parameter settings for the case.

Previously set parameter values remain active if the Narkomed 6400 is not switched to **System Standby**, even if the ventilator has previously been set to **Ventilator Standby** status or another ventilation mode, except as noted below. The settings return to the default settings whenever the Narkomed 6400 is powered on after being in **System Standby**.

When operating in Volume or SIMV Mode, Pset is updated to the last measured plateau pressure.

Volume Mode



CP00040

Figure 6-6. Selecting Volume Mode on Ventilator

To select Volume Mode:

1. Verify that ventilation parameters are appropriate.
2. Press **[Volume Mode]** ventilation mode button.
3. Check the alphanumeric display for the **Volume Mode ?** message.
4. Press the selector knob to confirm.
 - Ventilation starts immediately.
 - The light in the corner of the **[Volume Mode]** button is continuously lighted.
 - Pmax, Vt, Rate, and piston movement are displayed on the operator control panel.
 - The PEEP setting is shown on the alphanumeric display.

- If unconfirmed, the message **Volume Mode ?** disappears after 10 seconds without any change in the ventilation function.

Note: When the ventilator is turned on (placed in Volume mode), the apnea timer countdown returns to 15 seconds for caution alarms and 30 seconds for warning alarms.

SIMV Mode

Synchronized intermittent mandatory ventilation (SIMV) mode is a mixture of mechanical ventilation and spontaneous breathing. In SIMV mode the patient can breathe spontaneously at specified regular intervals. Between these intervals mandatory (that is, automatically delivered) ventilation strokes ensure a minimum degree of ventilation.

The mandatory ventilation strokes are the same as those for IPPV ventilation. They are defined by the parameters V_t , IPPV frequency f_{IPPV} , $T_I:T_E$, and T_{IP} . Each mandatory breath is followed by a pause in which the patient can breathe spontaneously.

In order to prevent the next mandatory breath being applied during the expiratory phase of spontaneous breathing, a trigger function ensures that the mandatory ventilation stroke is synchronized with the inspiratory spontaneous breathing phase during an expectation period.

The time between the end of each mandatory ventilation stroke and the beginning of the next is subdivided into a spontaneous breathing time T_{Spont} and a trigger time $T_{Trigger}$.

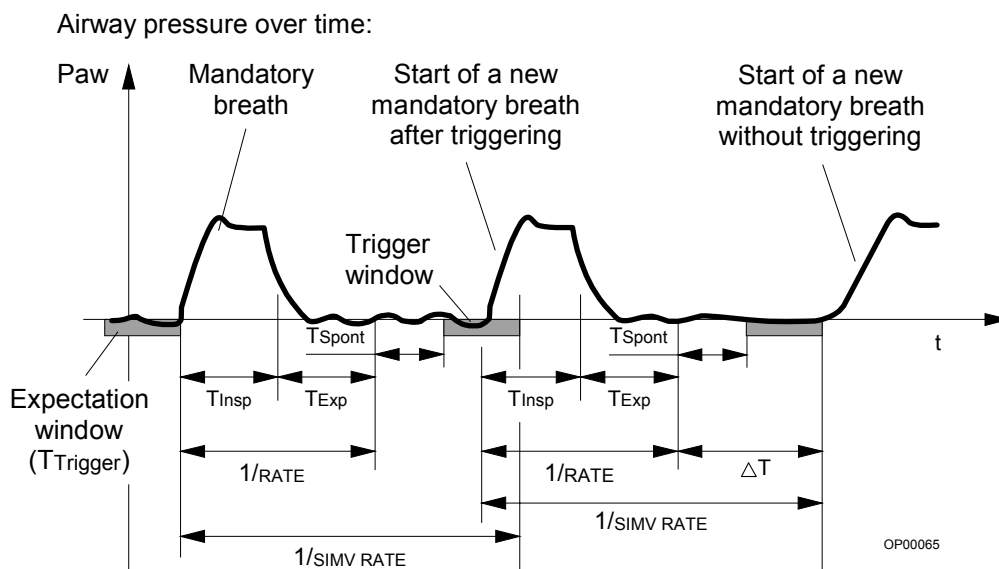


Figure 6-7. Waveform Showing SIMV Breathing

Trigger and spontaneous breathing times for SIMV mode:

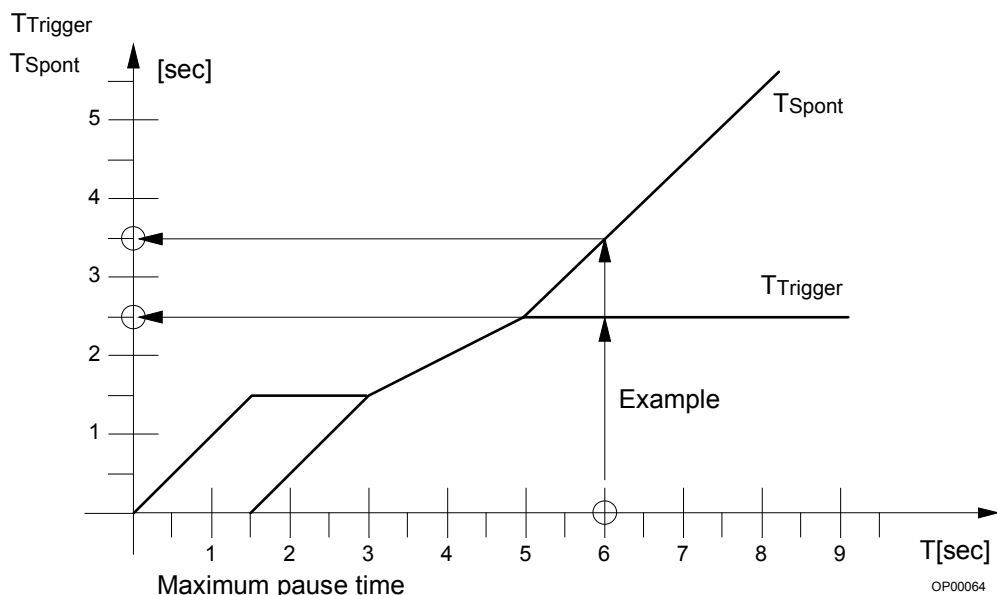


Figure 6-8. Waveform Showing Breathing Times for SIMV Mode

Example:

SIMV RATE= 5 / min

RATE = 10 / min

$$\Delta T = \frac{1}{SIMV\ RATE} - \frac{1}{RATE} = \frac{1}{5\ per\ min} - \frac{1}{10\ per\ min} = 6\ s$$

From the diagram we can see that:

$T_{Spont} = 3.5$ seconds and

$T_{Trigger} = 2.5$ seconds

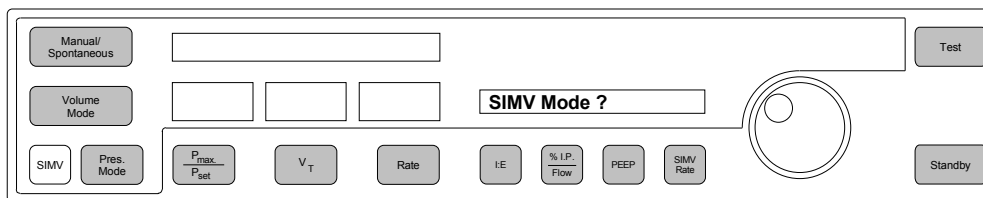
During the trigger time the system checks whether the airway pressure drops at least 0.5 cmH₂O below the pressure measured at the end of the expiration phase.

The mandatorily applied minute volume may increase if an automatic ventilation stroke is applied at the beginning of each trigger period. The duration of a mandatory stroke plus the spontaneous breathing time is calculated as follows:

$$\frac{1}{RATE} + T_{Spont} = 6\ s + 3.5\ s = 9.5\ s$$

This corresponds to a frequency of approximately 6 per minute and the applied minute volume increases to 6 per minute * Vt.

The SIMV mode on the Divan ventilator provides a minimum rate of mechanically assisted breaths, which are synchronized with the patient's spontaneous respiratory efforts, if applicable.



OP00041

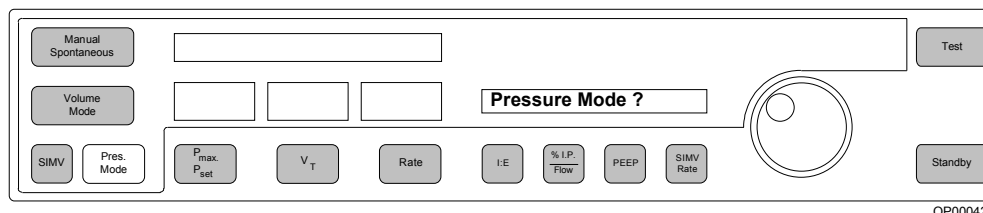
Figure 6-9. Selecting SIMV Mode on Ventilator

To select SIMV mode:

1. Verify that ventilation parameter values, including SIMV rate, are appropriate.
2. Press **[SIMV]** ventilation mode button.
3. Check the alphanumeric display for the **SIMV Mode ?** message.
4. Press the selector knob to confirm.
 - Ventilation starts immediately.
 - Pmax, Vt, and piston movement are displayed on the operator control panel.
 - **SIMV Rate = /min** appears on the alphanumeric display
 - If unconfirmed, the message **SIMV Mode ?** disappears after 10 seconds without any change in the ventilation function.

Note: When the ventilator is turned on (placed in SIMV mode), the apnea timer countdown returns to 15 seconds for caution alarms and 30 seconds for warning alarms. A special case exists for SIMV mode when ventilation frequency is set to less than 6 breaths per minute. The apnea countdown for pressure, CO₂, and volume alarms change to 30 seconds for cautions and 60 seconds for warnings, respectively, until the ventilation mode is changed or the ventilation frequency is set to at least 6 breaths per minute.

Pressure Mode



OP00042

Figure 6-10. Selecting Pressure Mode on Ventilator

To select Pressure mode:

1. Verify that ventilation parameters are appropriate.
2. Press **[Pres. Mode]** ventilation mode button.
3. Check the alphanumeric display for the **Pressure Mode ?** message.
4. Press the selector knob to confirm.
 - Ventilation starts immediately.
 - Pset, Rate, and piston movement are displayed on the operator control panel.
 - The PEEP setting is shown on the alphanumeric display.
 - If unconfirmed, the message **Pressure Mode ?** disappears after 10 seconds without any change in the ventilation function.

Note: When the ventilator is turned on (placed in Pressure mode), the apnea timer countdown returns to 15 seconds for caution alarms and 30 seconds for warning alarms.

Summary of Ventilator Modes

See “Summary of Ventilator Control Panel Information” on page A-1-17.

Preparation to Ventilate Pediatric Patients

To meet specifications of the ventilator, it is recommended that infant hoses be used for ventilating volumes of 200 mL or less.

1. If a tidal volume of 200 mL or less is selected from a higher setting, the system will automatically display the **Pediatric hoses?** message to prompt the clinician to change hoses.

Note: The Narkomed 6400 supports tidal volumes set as low as 10 mL.

2. Fit the infant hoses.
3. Press the selector knob to confirm.
4. Before connecting the patient, switch to **Ventilator Standby** and start the leak and compliance test to calculate the new compliance and check leakage.

Note: Ventilator accuracy specifications may not be met if low compliance pediatric hoses are not used with tidal volumes of 200 mL or less.

Pressure peaks should be avoided with pediatric patients.

During inspiration, the fresh gas is stored in the breathing bag. The pressure built up in the breathing bag when working with high flow rates and long inspiration times may be higher than the end-inspiratory pressure in the patient, particularly when using a small breathing bag. Even at a fresh gas flow of 4 L/min, a pressure peak may arise at the beginning of the expiration phase as fresh gas streams out of the breathing bag. This is distinctively possible in combination with long inspiration time and can be avoided by reducing the fresh gas flow or using a larger breathing bag.

Warning: The clinician must perform a leak and compliance test after any change in patient hoses.

Warning: The patient must be disconnected prior to the start of the ventilator leak and compliance test.

7

Checkout Procedures

This section outlines recommended procedures that should be performed daily and before each case to ensure that the Narkomed 6400 is ready for use.


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Daily Checkout

Daily checkout must be performed to assure the Narkomed 6400 is ready for use. This is a recommended procedure. Follow the institution's policies for specific checkout procedures.

If the Narkomed 6400 fails any checkout routine, do not use it until corrective action is taken. If indicated, contact an authorized representative of DrägerService for inspection of the unit.

Warning: If the Narkomed 6400 fails any procedures identified by an important note symbol  do not use it. Contact an authorized representative of DrägerService for inspection of the unit.


Warning: Do not insert any additional components into or modify the Narkomed 6400 after the checkout procedure has been started.

Warning: Do not use expandable patient hoses in the breathing system. Changing the hose length results in a change in compliance and can result in incorrect tidal volume delivery to the patient.


Preparation for Checkout

1. Enter the Narkomed 6400 serial number, located on the side wall to the left of the cylinder yokes, into the anesthesia record. See "Narkomed 6400 Rear View" on page 2-11.
2. Verify the presence of a valid inspection sticker on the rear of the Narkomed 6400, indicating that it has been serviced and inspected by an authorized representative of DrägerService. Verify the presence of a cylinder wrench, tethered adjacent to one of the cylinders.
3. Connect the electrical power cable to a hospital grade live 20 amp AC receptacle that accepts and properly grounds the power cable. DO NOT use "cheater" plugs. The term "cheater plug" implies any and all electrical plugs or other devices that can inhibit or prohibit the proper grounding of the anesthesia machine.

Emergency Ventilation Equipment Verification


4.  Verify that backup ventilation equipment is available and functional.


Oxygen Cylinder - High Pressure System

5.  Check the oxygen cylinder supplies.
 - a. Turn the system power switch to the **STANDBY** position.

Note: This step initiates a complete system reset and calibration. See “Start-up Screen” on page 3-2 and “Ventilator Self-Test” on page 3-4 for a complete description. If the system reset prompt dialog box were to appear, it would mean that the machine had been running continuously for 30 days. See “System Reset and Calibration” on page 3-5.
 - b. Disconnect all pipeline gas supply hoses.
 - c. Close the oxygen cylinder valve and remove the cylinder from the yoke. Verify that there is only one cylinder gasket and that two index pins are present. Verify that the cylinder matches the yoke label. Place the cylinder back in its yoke.
 - d. Open the oxygen cylinder and check the cylinder pressure gauge. A full oxygen cylinder should indicate a pressure of about 2000 psi. Replace any cylinder with a pressure less than 1000 psi. To check for a high pressure leak, close the cylinder and observe the cylinder pressure gauge for a prominent decrease in the pressure. With the oxygen cylinder closed, press the oxygen flush button until the oxygen cylinder pressure gauge indicates no pressure.

Absorber System and Patient Circuit Verification

6.  Ventilator Piston and Compact Breathing System Verification
 - a. Lift table top.
 - b. Verify that piston and compact breathing system are installed.
 - c. Verify lever in latch position.
7. Verification of System Hoses
 - a. Verify a secure connection between the fresh gas hose and the fresh gas inlet of the ventilator.
 - b. Verify secure connections of the breathing pressure pilot line between the patient sensor interface panel and the ventilator connector.
 - c. Verify secure connections of the oxygen sensor to the inspiratory valve dome and to the patient sensor interface panel.
 - d. Verify secure connections of the ultrasonic flow sensor to the 22 mm connector of the expiratory valve and to the patient sensor interface panel.


- e. Verify that the ultrasonic flow sensor electronics housing is securely latched to the flow housing.
 - f. Check for moisture accumulation in the 22 mm hose between the bag connection on the ventilator and the short bag arm connection. Remove any moisture found. Verify secure connection of both ends of the hose.
 - g. Verify secure connection of a breathing bag of proper capacity and appropriate construction to the long bag arm connection.
 - h. Check for moisture accumulation in the 22 mm hose between the bag connection on the ventilator and the short bag arm connection. Remove any moisture found.
 - i. Verify secure connection of a 22 mm breathing hose between the inspiratory valve on the absorber and the Y-piece.
 - j. Verify secure connection of a 22 mm breathing hose between the flow sensor on the expiratory valve of the absorber and the Y-piece.
 - k. Verify secure connections of the respiratory gas analysis sample line and semi-permeable tube between the Y-piece and the gas analysis pod front panel. Inspect the sample line for kinks or occlusions. Check the water trap's reservoir level; replace if filled to maximum capacity.
Note: Depending upon the design of the Y-piece purchased, the sample line attaches to the Y-piece itself (to the fitting opposite the 15 mm patient hose connection) or to a 15 mm sample connector inserted between the Y-piece and the patient hose.
 - l. Check for moisture accumulation in the 19 mm scavenger hose. Remove any moisture found.
 - m. Verify secure connections of the scavenger hose to the appropriate fittings of the ventilator and scavenger.
8.  Check the status of the absorbent in the absorber system. Make sure there is an adequate supply of carbon dioxide absorbent in the absorber system. Consult the absorbent manufacturer's literature and replace the absorbent when signs of exhausted absorbent are evident. Make sure that the color change represents the absorbent's true state of depletion and is not due to regeneration after a rest period.

If the Narkomed 6400 has been out of use or in storage or if it is suspected that the fresh gas has been left running at a high rate with no patient attached for an extended period of time, then replace the absorbent before using it. Draeger Medical recommends establishing a routine schedule with a sufficient safety margin for replacing the absorbent.

Warning: Absorbent is caustic and is a strong eye, skin, and respiratory tract irritant. When emptying the absorber, take care not to spill its caustic contents.

Caution: When changing the CO₂ absorbent, take care not to chip or crack the absorbent canister. Check the canister for signs of damage, especially along the rim, before reinstallation.

Oxygen Pipeline - High Pressure System

9.  Oxygen Pipeline Supply Verification
 - a. Inspect the oxygen supply hose for cracks or wear.
 - b. Connect the oxygen supply hose from the wall outlet fitting to the DISS inlet connectors.
 - c. Turn the Narkomed 6400 system switch to the **ON** position.
 - d. Check for sufficient oxygen pipeline pressure. The pressure, indicated on the oxygen pipeline pressure gauge below the flow control valve, should be between 50-55 psi. Open the flow control valve to a moderate value; the pressure indicated at the pipeline pressure gauge must not decrease more than 5 psi.

Ventilator Self-Test

See "Divan Ventilator Self-Test Flow Chart" on page A-4-1.

10. When the Narkomed 6400 is set to **ON**:
 - a. Verify that a single tone sounds from the ventilator buzzer and all display indicators light for about two seconds.
 - b. The **Self-test** message appears momentarily on the ventilator alphanumeric display.

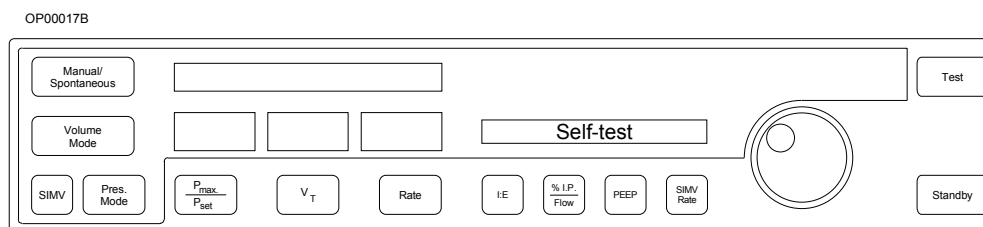



Figure 7-1. Ventilator Alphanumeric Display for Self-Test


11.  The ventilator will display a **Fresh gas off?** message and pause, waiting for the clinician to confirm.
 - a. Close all fresh gas flow control valves.
 - b. Press selector knob to confirm.
12. The ventilator will display a **APL=30cmH₂O?** message.
 - a. Verify that the APL valve is set to **Man** position.
 - b. Verify that the APL control is set to 30 cmH₂O.

- c. Press the selector knob to confirm.
13. The ventilator will display a **Y-piece open ?** message.
 - a. Make sure the Y-piece is attached to the breathing hoses, but the patient connection to the Y-piece is clear.
 - b. Press the selector knob to confirm.
14. The ventilator will display a **Ypiece occluded?** message.
 - a. Fit the patient connection of the Y-piece to the connector plug on the bag arm support pole.
 - b. Press the selector knob to confirm.
15. The system tests for patient circuit leakage and compliance.

The entire ventilator system is self calibrated. No other user intervention is required.


The system automatically switches to **Ventilator Standby** at the completion of the self-test.

Component System Diagnostics

16.  With the power switch in the **ON** position, wait for the system to complete its diagnostic checks. Ensure that **SYSTEM FUNCTIONAL** appears on the start-up screen. See “Start-up Screen” on page 3-2 for details.

The reserve power verification test is part of the power-up diagnostics of the Narkomed 6400. A low battery will cause the system to be **CONDITIONALLY FUNCTIONAL** and will require operator acknowledgment.

Calibrating the Oxygen Monitoring System

17.  The main screen contains an **[O2 Cal]** control button used to initiate an oxygen monitoring system calibration. To calibrate the oxygen monitoring system:
 - a. Remove the sensor assembly from the inspiratory valve dome and plug the dome with the inspiratory valve dome plug. (Do not disassemble the sensor assembly further.)
 - b. Expose the sensor to ambient air only (away from any open part of the breathing system), and allow it to stabilize for several minutes.

Note: Expose the sensor only to the 21% oxygen concentration normally found in ambient air.
 - c. Touch the **[O2 CAL]** control button and then touch **[Yes]** to confirm.

The length of time that the sensor takes to calibrate depends on the gas mixture which the sensor was exposed to before calibration. If the sensor was exposed to 21% oxygen for longer than one minute, calibration can take as little as 10 seconds. If the sensor was exposed

to higher concentrations of oxygen, calibration may last up to 50 seconds. Typically, calibration lasts less than 30 seconds.


- d. When the calibration is completed, pull the inspiratory valve dome plug and reinsert the sensor assembly.

If during or at the end of the calibration period the calibration was not successful, the condition is also indicated by one of the following advisory messages:


- **O2 SENSOR DISC**
- **O2 CAL ERR**
- **O2 CAL DUE.**

The oxygen sensor may be calibrated by the clinician at other times also. See “Calibrating the Oxygen Monitoring System” on page 5-18 and “Last O2 Calibration” on page 5-22 for more information.

Nitrous Oxide Cylinder - High Pressure System


18.  Check the nitrous oxide cylinder supply (if installed).
 - a. Close the nitrous oxide cylinder valve and remove the cylinder from the yoke. Verify that there is only one cylinder gasket and that two index pins are present. Verify that the cylinder matches the yoke label. Place the cylinder back in its yoke.
 - b. Open the nitrous oxide flow control valve until the nitrous oxide pipeline and cylinder pressure gauges indicate zero pressure.
 - c. Close the nitrous oxide flow control valve.
 - d. Open the nitrous oxide cylinder and check the cylinder pressure gauge. A full nitrous oxide cylinder should indicate a pressure of about 745 psi. Replace any cylinder with a pressure less than 600 psi. To check for a high pressure leak, close the cylinder and observe the cylinder pressure gauge for a prominent decrease in the pressure.

Air Cylinder - High Pressure System


19.  Check air gas cylinder supply (if installed).
 - a. Close the air cylinder valve and remove the cylinder from the yoke. Verify that there is only one cylinder gasket and that two index pins are present. Verify that the cylinder matches the associated yoke label. Place the cylinder back in its yoke.
 - b. Open the air flow control valve until the air pipeline and cylinder pressure gauges indicate zero pressure.
 - c. Close the air flow control valve.
 - d. Open the air cylinder and check the cylinder pressure gauge. A full air cylinder should indicate a pressure of about 2000 psi. Replace any cylinder with a pressure less than 1000 psi. To check for a high

pressure leak, close the cylinder and observe the cylinder pressure gauge for a prominent decrease in the pressure.

**Nitrous Oxide
and Air
Pipelines -
High
Pressure
System**

20.  Pipeline Supply Verification
 - a. Inspect the supply hoses for cracks or wear.
 - b. Connect the appropriate hospital pipeline supply hoses from the wall outlet fittings to the DISS inlet connectors.
 - c. Check for sufficient pipeline pressure. The pressure for each gas, indicated on the pipeline pressure gauge below the flow control valves, should be between 50-55 psi. Open the flow control valve to a moderate value; the pressure indicated at the pipeline pressure gauge must not decrease more than 5 psi.
 - d. Verify that the correct gases are supplied to all Narkomed 6400 pipeline inlets.

**Vaporizer -
Low Pressure
System**


21.  Vaporizer Verification

Check for sufficient supply of liquid anesthetic in the vaporizer(s). The liquid level, as indicated by the vaporizer sight glass, must be between the minimum and maximum markings.

 - a. Make sure the fill and drain valves are completely closed.
 - b. Check the vaporizer interlock system, which prevents more than one vaporizer from being activated simultaneously. Make sure that when one vaporizer handwheel is turned to a setting greater than "0", the other remains locked in its "0" position. Test the system for both vaporizers. Then, turn both vaporizers to the "0" position.


Note: If the Narkomed 6400 is equipped with the optional Three Vaporizer Mount and Interlock System, test the interlock system. Adjust the selector lever, and make sure that when one vaporizer handwheel is turned to a setting greater than "0", the other two remain locked in their "0" positions. Test the system for all three vaporizers. Then, turn all vaporizers to the "0" position.

**Flow
Control - Low
Pressure
System**


22.  System Gas Circuit Flow Control Verification

Check the function of the flowmeters. Adjust the flow control knob for each gas and verify the proper operation of the corresponding flowmeters. The float must move freely over the full range of each flowmeter.

**Oxygen
Failure
Protection
Device - Low
Pressure
System**


23.  Check the oxygen failure protection device (OFPD). With each gas available set to a flow of about 1 L/min, discontinue the oxygen flow by disconnecting the oxygen pipeline supply hose and closing the oxygen cylinder(s). The flow of all other gases, as indicated by their flowmeters, must decrease in proportion to the decrease in oxygen flow and eventually shut off.

**Oxygen Ratio
Controller -
Low Pressure
System**

24.  Check the function of the oxygen ratio controller (ORC). With the nitrous oxide flow control valve open to a flow of 10 L/min, vary the oxygen flow with the oxygen flow control valve. The nitrous oxide flow, as indicated on the nitrous oxide flowmeter, must automatically vary in response to the adjustment of the oxygen flow control valve.

The ORC must maintain a fresh gas oxygen/nitrous oxide flow ratio of at least 21% oxygen.

**APL Valve
(knob-style)**


25.  Check the knob-style APL valve, making sure it can relieve excess gas from the breathing system into the scavenger system. To check the APL valve's flow resistance:

- Verify that the APL knob is set to 30 cmH₂O.
- Set the ventilation mode to Manual/Spontaneous Mode.
- Set the fresh gas flow to 20 L/min.
- Occlude the patient Y-piece.
- Observe the pressure on the monitor rise to a steady state level of approximately 30 cmH₂O.

Note: This level can be determined by displaying the Software Pressure Gauge on the Narkomed 6400 monitor screen.

- Turn the APL knob to **Spont** position (the index mark on the knob lines up with the index mark on the bottom of the valve).
- Observe the pressure waveform on the monitor drops. The pressure now must not exceed 5 cmH₂O, the minimum apnea pressure threshold limit.

**APL Valve
(toggle-style)**

26.  Check the toggle-style APL valve, making sure it can relieve excess gas from the breathing system into the scavenger system. To check the APL valve's flow resistance:


- Set the APL valve toggle to the **SPONT** position. Verify that the APL control is set to 30 cmH₂O.
- Set the ventilation mode to Manual/Spontaneous Mode.
- Set the fresh gas flow to 20 L/min.
- Occlude the patient Y-piece.

- e. Switch the APL toggle to the **MAN** position and observe the pressure on the monitor rise to a steady state level of approximately 30 cmH₂O.

Note: This level can be determined by displaying the Software Pressure Gauge on the Narkomed 6400 monitor screen.


- f. Switch the APL toggle to the **SPONT** position.
- g. Observe the pressure waveform on the monitor drops. The pressure now must not exceed 5 cmH₂O, the minimum apnea pressure threshold limit.


Oxygen - Low Pressure System

27.  Oxygen Verification
 - a. Make sure all vaporizers are closed.
 - b. Test the oxygen flush. Pressing the oxygen flush button must result in an audible gas flow sound, accompanied by a marked increase in oxygen concentration in the breathing system.
 - c. Verify the delivered oxygen concentration. Open the patient Y-piece. Repeatedly flush the patient breathing system by pressing the oxygen flush button. Open the oxygen flow control valve to a flow of 8 L/min and close the other flow control valves. The oxygen measurement display area should indicate 97 to 100% oxygen concentration.
 - d. Open the oxygen flow control valve to an 8 L/min flow and close all other flow control valves. Sniff the gas coming from the patient Y-piece in the breathing system. There should be no noticeable odor.
28. Close all fresh gas flow control valves. Check for free gas passage in the patient breathing system. Wear a surgical mask to inhale and exhale through the breathing system (each limb individually, if possible). Verify the unidirectional flow in each limb and then reconnect the tubing.


Open Reservoir Scavenger System

Verify the safe performance of the open reservoir scavenging system. With the scavenging system properly installed and operating, test for positive and negative pressure relief.

29.  To test for positive pressure relief:
 - a. Connect a DISS vacuum hose to the threaded terminal on the left-hand side of the scavenger. Alternatively, attach a wall suction hose onto the adapter's hose barb fitting using the adapter provided.
 - b. Verify that the ventilator is in Manual/Spontaneous Mode.
 - c. Occlude the patient Y-piece.
 - d. Adjust the scavenger needle valve to a completely closed position by turning it fully clockwise.

- e.
 - if your Narkomed 6400 is equipped with the knob-style APL valve, rotate the APL valve adjustment knob fully counterclockwise to **Spont** position (the index mark on the knob lines up with the index mark on the bottom of the APL valve).
 - if your Narkomed 6400 is equipped with the toggle-style APL valve, set the toggle on the APL valve to **SPONT** position.
 - f. Open the oxygen flow control valve to 10 L/min.
 - g. Observe the breathing pressure on the monitor. The pressure on the waveform display should not exceed 5 cmH₂O.
30.  To test for negative pressure relief:
- a. Connect a DISS vacuum hose to the threaded terminal on the left-hand side of the scavenger. Alternatively, attach a wall suction hose onto the adapter's hose barb fitting using the adapter provided.
 - b. Verify that the ventilator is in Manual/Spontaneous Mode.
 - c. Verify that the suction waste gas disposal system is active.
 - d. Occlude the patient Y-piece.
 - e. Adjust the scavenger needle valve to a flowmeter indication between the two white lines.
 - f. Close all flow control valves.
 - g. Observe that the breathing bag becomes fully collapsed.
 - h. Open and close the patient Y-piece.
 - i. Observe the breathing pressure on the monitor. The value on the waveform display should not change.


Scavenger Interface for Passive Systems

31.  To test the scavenger interface for passive systems:
- a. Occlude the patient Y-piece.
 - b. Set the ventilator to Manual/Spontaneous Mode.
 - c.
 - if your Narkomed 6400 is equipped with the knob-style APL valve, rotate the APL valve adjustment knob fully counterclockwise to **Spont** position (the index mark on the knob lines up with the index mark on the bottom of the APL valve).
 - if your Narkomed 6400 is equipped with the toggle-style APL valve, set the toggle on the APL valve to **SPONT** position.
 - d. Open the oxygen flow control valve to a flow of 10 L/min and occlude the 19 mm scavenger terminal labeled **EXHAUST**.
 - e. The flow of oxygen exits the system through the positive pressure safety relief valve. At this point, the monitor's breathing pressure waveform display must indicate a pressure of less than 10 cmH₂O.

Monitors

32. Check the alarm limit settings. The Narkomed 6400 automatically sets monitor alarm limits to a default configuration when the power switch is turned on. Check these settings and adjust them if necessary. Alarm limit settings are accessed by touching the appropriate parameter box and then the **[Alarms]** tab on the notebook displayed.

Note: Alarm limits may be adjusted at the beginning of or during a case. In section 4, see: “Agent Alarms” on page 4-8 and “Carbon Dioxide Alarms” on page 4-14; and in section 5, see: “Pressure Alarms” on page 5-9, “Minute Volume Alarms” on page 5-16, and “Oxygen Alarms” on page 5-23 for complete details.

33.  Test the alarm functions of all monitors. Simulate alarm conditions and check for appropriate alarm signals.
34. Flush the system with 100% oxygen by pressing the oxygen flush button.
35. If the Narkomed 6400 is configured with Air-Only Mode, use the following procedure to verify proper operation:
 - a. Enable Air-Only Mode by pressing the **[Air-Only Mode]** control button and then pressing the **[Continue]** button in the dialog box.
 - b. Turn all flow control knobs completely off and verify that no fresh gas (including oxygen) is flowing through any flow tube.
 - c. Verify that the message Air-Only Mode is displayed at the bottom of the oxygen parameter box.
 - d. Turn up the air flow control and verify that flow of air is possible with no oxygen flowing.
 - e. Turn off the air flow control.
 - f. If Air-Only Mode will not be used in the next case, return to N₂O/Air/O₂ operation by pressing the **[N2O/Air/O2]** control button and then pressing the **[Continue]** button in the dialog box.

Total Breathing System Leak Test

This test detects any significant leaks in the reservoir bag, its hose, and the fresh gas circuit and vaporizers, as well as the ventilation system tested in the previous step. This test is particularly recommended after changing or filling vaporizers.

36. To perform the total system leak test:
 - a. Verify that all fresh gas flow control valves are closed. Only the minimum oxygen flow of less than 200 ml/min should be present.
 - b. Verify that the patient Y-piece is occluded.
 - c. Set the APL valve to **Man** position and the value to 50 cmH₂O.
 - d. Set the Divan ventilator to Manual/Spontaneous mode.

- e. On the main screen task bar on the Narkomed 6400 monitor screen, press **[Press Gauge]**.
- f. Use the oxygen flush button to pressurize the system to approximately 30 cmH₂O. If the pressure is significantly above 30 cmH₂O, lift the top of the APL valve knob or tap the APL valve toggle (depending on type of APL valve) to relieve pressure.

If the Pressure Gauge stabilizes above 30 cmH₂O, the total leakage of Subsystems 1, 2, and 3 is less than the minimum oxygen flow. Subsystem 3 leakage is less than the difference between the minimum oxygen flow and the leak rate reported during the Leak and Compliance Test.
- g. If the Pressure Gauge stabilizes below 30 cmH₂O, increase the oxygen flow until the pressure stabilizes at close to 30 cmH₂O. Subsystem 3 leakage is approximately the difference between the oxygen flow and the leak rate reported during the Leak and Compliance Test.
- h. One at a time, turn on each mounted vaporizer and repeat steps f. and g.
- i. Close all vaporizers, close the oxygen flow control valve, and return the Divan ventilator to **Ventilator Standby** status.


Final Position

37. At the completion of the daily checkout procedure, verify that the final status of the Narkomed 6400 is as follows:
 - a. All vaporizers off (handwheels set to zero)
 - b. APL valve set to 10 cmH₂O (and toggle set to **MAN**, if applicable).
 - c. All flowmeters indicating zero (or minimum)
 - d. Patient suction system ready for use, if applicable
 - e. Breathing system ready to use (bag in place and all hoses connected properly)
 - f. The ventilator is in **Ventilator Standby** status.

Preuse Checkout

The following abbreviated checkout procedure applies to the Narkomed 6400 when used in successive cases. It may be performed only after the Narkomed 6400 has undergone the initial daily checkout procedure.


This is a recommended procedure. Follow the institution's policies regarding specific checkout procedures. If the Narkomed 6400 fails any procedure, do not use it until corrective action is taken. If indicated, contact an authorized representative of DrägerService for inspection of the unit.


Warning: If the Narkomed 6400 fails any procedures identified by an important note symbol  do not use it. Contact an authorized representative of DrägerService for inspection of the unit.

Warning: Do not insert any additional components into or modify the Narkomed 6400 after the checkout procedure has been started.

Warning: Do not use expandable patient hoses in the breathing system. Changing the hose length results in a change in compliance and can result in incorrect tidal volume delivery to the patient.

Breathing System

1.  Verification of System Hoses
 - a. Verify a secure connection between the fresh gas hose and the fresh gas inlet of the ventilator.
 - b. Verify secure connections of the breathing pressure pilot line between the patient sensor interface panel and the ventilator connector.
 - c. Verify secure connections of the oxygen sensor to the inspiratory valve dome and to the patient sensor interface panel.
 - d. Verify secure connections of the ultrasonic flow sensor to the 22 mm connector of the expiratory valve and to the patient sensor interface panel.
 - e. Verify that the ultrasonic flow sensor electronics housing is securely latched to the flow housing.
 - f. Check for moisture accumulation in the 22 mm hose between the bag connection on the ventilator and the short bag arm connection. Remove any moisture found. Verify secure connection of both ends of the hose.
 - g. Verify secure connection of a breathing bag of proper capacity and appropriate construction to the long bag arm connection.

- h. Check for moisture accumulation in the 22 mm patient breathing hoses. Remove any moisture found.
 - i. Verify secure connection of a 22 mm breathing hose between the inspiratory valve on the absorber and the Y-piece.
 - j. Verify secure connection of a 22 mm breathing hose between the flow sensor on the expiratory valve of the absorber and the Y-piece.
 - k. Verify secure connections of the respiratory gas analysis sample line and semi-permeable tube between the 15 mm patient side of the Y-piece and the gas analysis pod front panel. Inspect the sample line for kinks or occlusions. Check the water trap's reservoir level; replace if filled to maximum capacity.
 - l. Check for moisture accumulation in the 19 mm scavenger hose. Remove any moisture found.
 - m. Verify secure connections of the scavenger hose to the appropriate fittings of the ventilator and scavenger.
2.  Check the status of the absorbent in the absorber system. Make sure there is an adequate supply of carbon dioxide absorbent in the absorber system. Consult the absorbent manufacturer's literature and replace the absorbent when signs of exhausted absorbent are evident. Make sure that the color change represents the absorbent's true state of depletion and is not due to regeneration after a rest period.


If the Narkomed 6400 has been out of use or in storage or if it is suspected that the fresh gas has been left running at a high rate with no patient attached for an extended period of time, then replace the absorbent before using it. Draeger Medical recommends establishing a routine schedule with a sufficient safety margin for replacing the absorbent.

Warning: Absorbent is caustic and is a strong eye, skin, and respiratory tract irritant. When emptying the absorber, take care not to spill its caustic contents.

Caution: When changing the CO₂ absorbent, take care not to chip or crack the absorbent canister. Check the canister for signs of damage, especially along the rim, before reinstallation.
3. Close all vaporizers and fresh gas flow control valves.
4. Set the ventilator mode to Manual/Spontaneous Mode.


5.
 - if your Narkomed 6400 is equipped with the knob-style APL valve, rotate the APL valve adjustment knob fully counterclockwise to **Spont** position (the index mark on the knob lines up with the index mark on the bottom of the APL valve).
 - if your Narkomed 6400 is equipped with the toggle-style APL valve, set the toggle on the APL valve to **SPONT** position.
6. Occlude the Y-piece and activate the oxygen flush button for 10 seconds.
7. Check for free gas passage in the patient breathing system. Placing a surgical mask over your mouth, inhale and exhale through the breathing system (each limb individually if possible). Verify the unidirectional flow in each limb and then reconnect the tubing.

**APL Valve
(knob-style)**

8.  Check the knob-style APL valve, making sure it can relieve excess gas from the breathing system into the scavenger system. To check the APL valve's flow resistance:
 - a. Verify that the APL knob is set to 30 cmH₂O.
 - b. Set the ventilation mode to Manual/Spontaneous Mode.
 - c. Set the fresh gas flow to 20 L/min.
 - d. Occlude the patient Y-piece.
 - e. Observe the pressure on the monitor rise to a steady state level of approximately 30 cmH₂O.

Note: This level can be determined by displaying the Software Pressure Gauge on the Narkomed 6400 monitor screen.
 - f. Turn the APL knob to **Spont** position (the index mark on the knob lines up with the index mark on the bottom of the valve).
 - g. Observe the pressure waveform on the monitor drops. The pressure now must not exceed 5 cmH₂O, the minimum apnea pressure threshold limit.

**APL Valve
(toggle-style)**

9.  Check the toggle-style APL valve, making sure it can relieve excess gas from the breathing system into the scavenger system. To check the APL valve's flow resistance:
 - a. Set the APL valve toggle to the **SPONT** position. Verify that the APL control is set to 30 cmH₂O.
 - b. Set the ventilation mode to Manual/Spontaneous Mode.
 - c. Set the fresh gas flow to 20 L/min.
 - d. Occlude the patient Y-piece.



- e. Switch the APL toggle to the **MAN** position and observe the pressure on the monitor rise to a steady state level of approximately 30 cmH₂O.

Note: This level can be determined by displaying the Software Pressure Gauge on the Narkomed 6400 monitor screen.

- f. Switch the APL toggle to the **SPONT** position.
- g. Observe the breathing pressure on the monitor. The pressure on the waveform display should not exceed 5 cmH₂O.


Open Reservoir Scavenger System

Verify the safe performance of the open reservoir scavenging system. With the scavenging system properly installed and operating, test for positive and negative pressure relief.

10.  To test for positive pressure relief:
 - a. Connect a DISS vacuum hose to the threaded terminal on the left-hand side of the scavenger. Alternatively, attach a wall suction hose onto the adapter's hose barb fitting using the adapter provided.
 - b. Verify that the ventilator is in Manual/Spontaneous Mode.
 - c. Occlude the patient Y-piece.
 - d. Adjust the scavenger needle valve to a completely closed position by turning it fully clockwise.
 - e.
 - if your Narkomed 6400 is equipped with the knob-style APL valve, rotate the APL valve adjustment knob fully counterclockwise to **Spont** position (the index mark on the knob lines up with the index mark on the bottom of the APL valve).
 - if your Narkomed 6400 is equipped with the toggle-style APL valve, set the toggle on the APL valve to **SPONT** position.
 - f. Open the oxygen flow control valve to 10 L/min.
 - g. Observe the breathing pressure on the monitor. The pressure on the waveform display should not exceed 5 cmH₂O.
11.  To test for negative pressure relief:
 - a. Connect a DISS vacuum hose to the threaded terminal on the left-hand side of the scavenger. Alternatively, attach a wall suction hose onto the adapter's hose barb fitting using the adapter provided.
 - b. Verify that the ventilator is in Manual/Spontaneous Mode.
 - c. Verify that the suction waste gas disposal system is active.
 - d. Occlude the patient Y-piece.
 - e. Adjust the scavenger needle valve to a flowmeter indication between the two white lines.

- f. Close all flow control valves.
- g. Observe that the breathing bag becomes fully collapsed.
- h. Open and close the patient Y-piece.
- i. Observe the breathing pressure on the monitor. The value on the waveform display should not change.

Scavenger Interface for Passive Systems

12.  To test the scavenger interface for passive systems:
 - a. Occlude the patient Y-piece.
 - b. Set the ventilator to Manual/Spontaneous Mode.
 - c.
 - if your Narkomed 6400 is equipped with the knob-style APL valve, rotate the APL valve adjustment knob fully counterclockwise to **Spont** position (the index mark on the knob lines up with the index mark on the bottom of the APL valve).
 - if your Narkomed 6400 is equipped with the toggle-style APL valve, set the toggle on the APL valve to **SPONT** position.
 - d. Open the oxygen flow control valve to a flow of 10 L/min and occlude the 19 mm scavenger terminal labeled **EXHAUST**.
 - e. The flow of oxygen exits the system through the positive pressure safety relief valve. At this point, the monitor's breathing pressure waveform display must indicate a pressure of less than 10 cmH₂O.

Ventilator

13. To check the ventilator:
 - a. Attach a breathing bag to the patient Y-piece to simulate a lung.
 - b. Verify that the ventilator is set to Manual/Spontaneous Mode.
 - c. Set the fresh gas flow to 2 L/min of oxygen on the Narkomed 6400.
 - d. Verify that the APL valve is set to **Man** position.
 - e. Verify that the APL valve is adjusted to 30 cmH₂O.
 - f. Fill the breathing bag by depressing the O₂ flush button on the Narkomed 6400.
 - g. Squeeze the breathing bag. Observe that the airway pressure rises to approximately 30 cmH₂O.
 - h. Release the breathing bag. Observe that the airway pressure is released and the breathing bag reinflates.
 - i. Set appropriate ventilation parameters for the next patient.
 - j. Set ventilator to Volume Mode.
 - k. Verify that the ventilator cycles properly and that tidal volume and pressure waveform are correct on the monitor.

- l. Set PEEP to 15 cmH₂O.
- m. Verify that PEEP is correct on the monitor.
- n. Set PEEP to 0 cmH₂O.
- o. Press ventilator **[Standby]** button.
- p. Remove breathing bag at Y-piece.

Ventilator Leak and Compliance Test

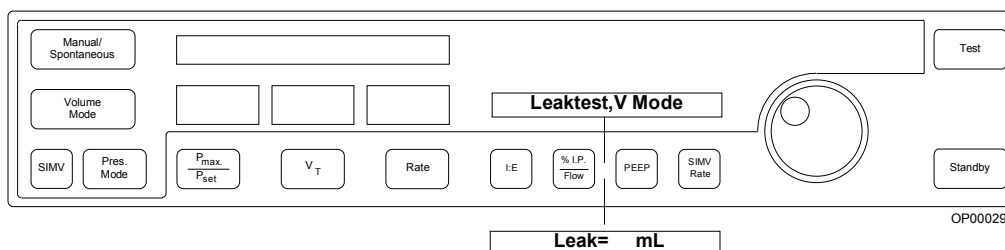


Figure 7-2. Ventilator Leak and Compliance Test Displays

The leak and compliance test detects any significant leaks in the ventilation system. The breathing bag, its hose, and the fresh gas circuit are not included in the test. The overall system compliance is checked at the same time. This test can only be initiated in **Ventilator Standby** status. A manual leak and compliance test should be performed each time the breathing hoses are changed or whenever system components are disassembled and reassembled, or changed.

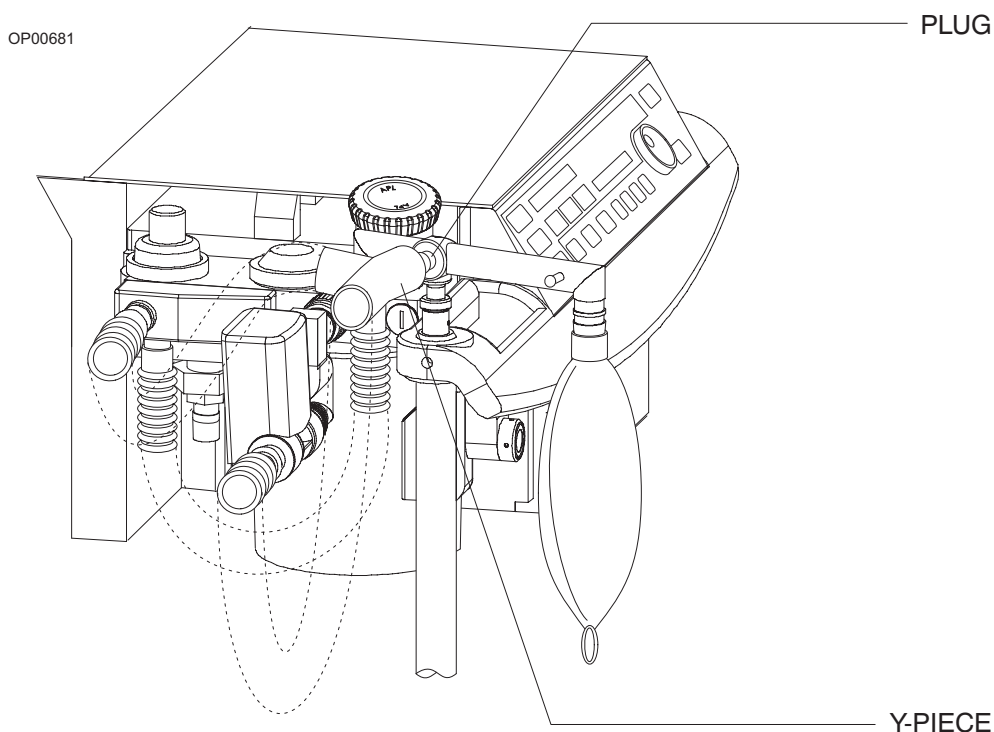


Figure 7-3. Ventilator Leak and Compliance Test Set-Up

14. To perform the leak and compliance test:

- a. Close all fresh gas flow control valves.
- b. Fit the patient connection of the Y-piece to the plug on the bag mount arm.
- c. Press the **[Test]** control button for at least three seconds. The LED on the button will flash and then light continuously.

As the test progresses, **Leaktest, V Mode** is displayed on the alphanumeric display, then **compliance test**.

The system automatically displays **Leak = __mL/min** with a numeric value then switches to **Ventilator Standby** at the completion of the leak and compliance test.

Note: It is recommended that the Divan control panel and patient circuit not be disturbed during the Ventilator Leak and Compliance Test.

If it is necessary to abort a Ventilator Leak and Compliance Test, the clinician should press and hold the **[STANDBY]** button until **STANDBY** appears on the Divan control panel.

Total Breathing System Leak Test

This test detects any significant leaks in the reservoir bag, its hose, and the fresh gas circuit and vaporizers, as well as the ventilation system tested in the previous step. This test is particularly recommended after changing or filling vaporizers.

15. To perform the total system leak test:

- a. Verify that all fresh gas flow control valves are closed. Only the minimum oxygen flow of less than 200 ml/min should be present.
- b. Verify that the patient Y-piece is occluded.
- c. Set the APL valve to **Man** position and the value to 50 cmH₂O.
- d. Set the Divan ventilator to Manual/Spontaneous mode.
- e. On the main screen task bar on the Narkomed 6400 monitor screen, press **[Press Gauge]**.
- f. Use the oxygen flush button to pressurize the system to approximately 30 cmH₂O. If the pressure is significantly above 30 cmH₂O, lift the top of the APL valve knob or tap the APL valve toggle (depending on type of APL valve) to relieve pressure.


If the Pressure Gauge stabilizes above 30 cmH₂O, the total leakage of Subsystems 1, 2, and 3 is less than the minimum oxygen flow. Subsystem 3 leakage is less than the difference between the minimum oxygen flow and the leak rate reported during the Leak and Compliance Test.

- g. If the Pressure Gauge stabilizes below 30 cmH₂O, increase the oxygen flow until the pressure stabilizes at close to 30 cmH₂O. Subsystem 3 leakage is approximately the difference between the oxygen flow and the leak rate reported during the Leak and Compliance Test.
- h. One at a time, turn on each mounted vaporizer and repeat steps f. and g.
- i. Close all vaporizers, close the oxygen flow control valve, and return the Divan ventilator to **Ventilator Standby** status.

Monitors

16. Check the alarm limit settings. The Narkomed 6400 automatically sets monitor alarm limits to a default configuration when the power switch is turned on. Check these settings and adjust them if necessary. Alarm limit settings are accessed by touching the appropriate parameter box and then the **[Alarms]** tab on the notebook displayed.

Note: Alarm limits may be adjusted at the beginning of or during a case. In section 4, see: "Agent Alarms" on page 4-8 and "Carbon Dioxide Alarms" on page 4-14; and in section 5, see: "Pressure Alarms" on page 5-9, "Minute Volume Alarms" on page 5-16, and "Oxygen Alarms" on page 5-23 for complete details.

17.  Test the alarm functions of all monitors. Simulate alarm conditions and check for appropriate alarm signals.
18. Flush the system with 100% oxygen by pressing the oxygen flush button.

Final Position

19. At the completion of the Daily Checkout procedure, verify that the final status of the Narkomed 6400 is as follows:
 - a. All vaporizers off (handwheels set to zero)
 - b. APL valve set to 10 cmH₂O (and toggle set to **MAN**, if applicable).
 - c. All flowmeters indicating zero (or minimum)
 - d. Patient suction system ready for use, if applicable
 - e. Breathing system ready to use (bag in place and all hoses connected properly).

8

Operation Summary

This section summarizes basic operation of the Narkomed 6400: how to start a new case, put a case in monitoring standby, resume a case, and continue when operation is interrupted.

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Typical Operation

Before Beginning a New Case

Before operating the Narkomed 6400, observe the power-up diagnostics and perform the following checkout procedures to verify that it is ready for use. See “Daily Checkout” on page 7-2 and “Preuse Checkout” on page 7-14. This is a recommended procedure. Follow institutional policies for specific checkout procedures.

After the Narkomed 6400 is powered on and diagnostic tests are successfully completed, the machine is ready for use immediately.

Putting the System in Monitor Standby

Prior to beginning a case, the clinician may place the monitor in **Monitor Standby** status temporarily.

1. Make sure the DIVAN ventilator is in Standby. Monitor Standby cannot be entered unless the DIVAN is in Standby.
2. Touch the **[Monitor Standby]** command button.
 - If the total fresh gas flow is one liter per minute or less, the confirmation dialog box shown in Figure 8-1 is displayed:

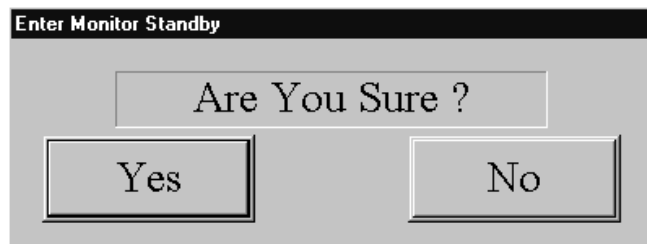


Figure 8-1. Monitor Standby Confirmation Dialog Box

- If the total fresh gas flow is greater than one liter per minute, the confirmation dialog box shown in Figure 8-2 is displayed. Reducing the fresh gas flow to below one liter per minute will remove the warning text from the dialog box.

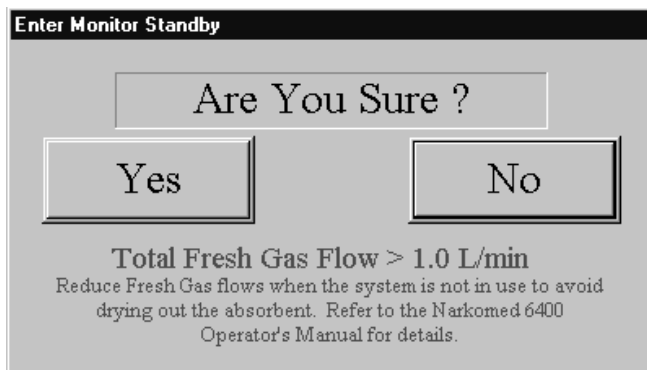


Figure 8-2. Monitor Standby Confirmation Dialog Box - Fresh Gas Flow > 1 L/min

3. • Touch **[No]** to resume monitoring; **Monitor Standby** status is cancelled.
- Touch **[Yes]** to suspend monitoring. The dialog box closes and **Monitor Standby** status is active:
 - if the total fresh gas flow is one liter per minute or less, the monitor standby screen shown in Figure 8-3 is displayed
 - if the total fresh gas flow is greater than one liter per minute, the monitor standby screen shown in Figure 8-4 is displayed; reducing the fresh gas flow to below one liter per minute will remove the warning text from the dialog box.

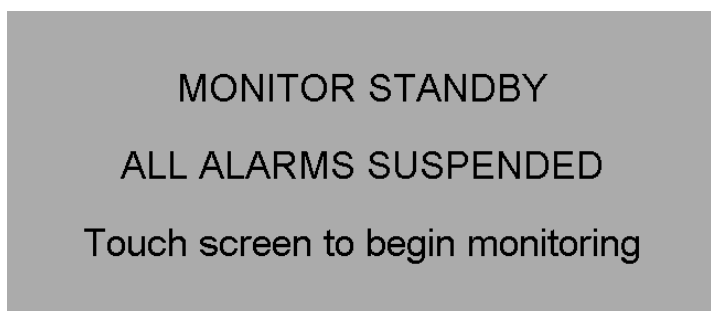


Figure 8-3. Monitor Standby Screen



Figure 8-4. Monitor Standby Screen - Fresh Gas Flow > 1 L/min

When the clinician confirms the selection of **Monitor Standby** status, the Narkomed 6400 immediately stops all monitoring functions. All alarms are suspended. Standby messages are posted. Data collection stops; no waveforms and no numeric data are displayed. No trend, data log, or alarm log data is collected. After 20 seconds a screen saver starts. Touching the screen activates the case selection dialog box.

Beginning a Case

1. Touch anywhere on the screen.
A dialog box is displayed.

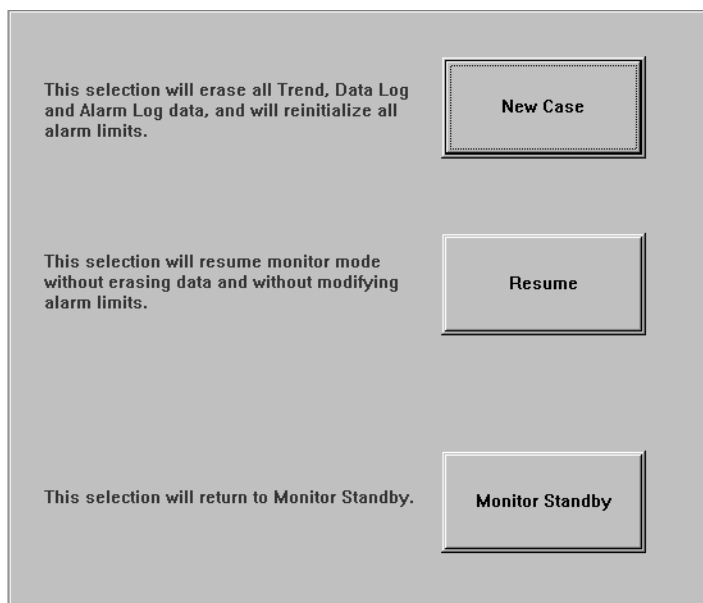


Figure 8-5. Case Selection Dialog Box

2. Touch **[New Case]**.

The Narkomed 6400 resets the following:

- a screen message **Starting New Case ...** appears.
- the data log, the alarm log, and existing trends in the trend window are erased
- default alarm limits and settings are restored
- the main screen appears and displays are updated within seven seconds
- pressure and volume alarms are set according to the ventilator status
- agent/N₂O and CO₂ alarms are turned to Standby
- 120-second alarm silence countdown begins

3. Check the alarm limit settings.

The monitor automatically sets alarm limits and other monitor parameters to a default configuration when starting a new case. Check the settings in the following table of Narkomed 6400 monitoring parameter default settings and adjust them if necessary.

Note: For information on setting alarm limits for parameters monitored by the Integrated Patient Monitor, see the *Operator's Instruction Manual for the Integrated Patient Monitor Option*.

Parameter	Default Value
Oxygen high alarm limit	100%
Oxygen low alarm limit	30%
Minute volume low alarm limit	1.0 liters
Pressure high alarm limit	50 cmH ₂ O
PEEP high alarm limit	6 cmH ₂ O
Pressure threshold	12 cmH ₂ O
Audio alarm silence	120 seconds
Agent high alarm limit	3% isoflurane, enflurane, halothane 6% sevoflurane 9% desflurane
Agent low alarm limit	0%
Displayed trace (Agent/N ₂ O)	Agent
Scale	Desflurane 20%; other agents 10%
CO ₂ Units	mmHg
End Tidal CO ₂ high alarm limit	50 mmHg
End Tidal CO ₂ low alarm limit	8 mmHg
Inspiratory CO ₂ high alarm limit	4 mmHg

Warning: In circle systems, the gas mixture in the patient circuit is not necessarily the same as that in the fresh gas flow. This is particularly true when the patient rebreathes a significant portion of previously exhaled gases, for example, when fresh gas flow rates are low. It is important to monitor the gas mixture in the patient circuit. Adjust the fresh gas flow to meet the patient's requirements and to compensate for patient uptake and system leakage. Furthermore, compensation must be made for any gas withdrawn through sample lines and not returned.

Resuming a Case

The clinician may put the system in **Monitor Standby** status and subsequently return to the same case.

1. Touch anywhere on the monitor standby screen.

A dialog box is displayed.

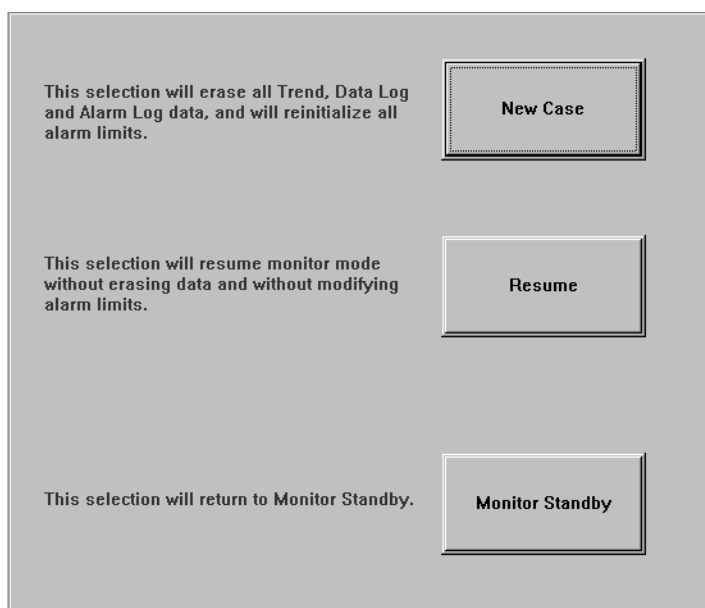


Figure 8-6. Case Selection Dialog Box

2. Touch the **[Resume]** command button.

The Narkomed 6400 returns to the following settings:

- waveforms and numeric readings return to the screen; screen displays of the last stored configuration are updated within seven seconds
- monitor resumes collecting patient trend, data log, and alarm log data
- **Alarm Suspend** status is canceled
- previous alarm state is restored
- alarm notification system is resumed.

Using the Oxygen Flush

To use the oxygen flush, press the oxygen flush button, located on the front of the Narkomed 6400, for a few seconds. This introduces an unmetered flow of pure oxygen into the breathing circuit at a rate of about 55 L/min.

Automatic Data Recording

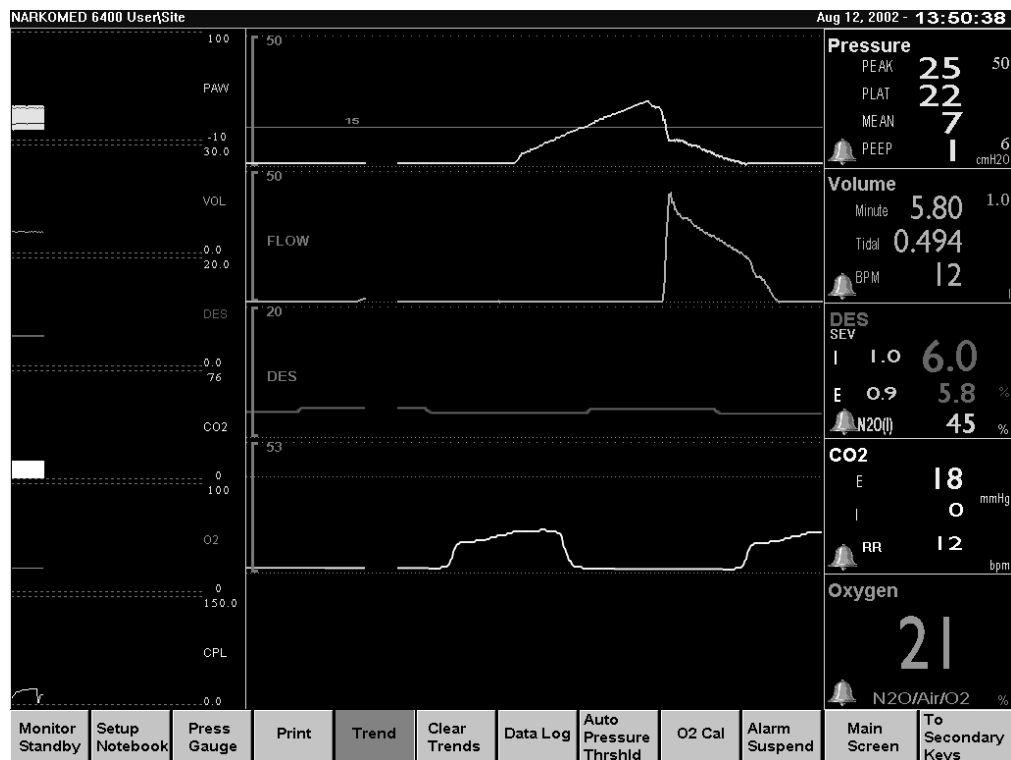


Figure 8-7. Trend Window

Trend Window

Touching the **[Trend]** button in the main screen taskbar adds a window on the left of the main screen that summarizes data trends calculated by the Narkomed 6400 processor.

Up to two hours of trend data are displayed in the trend window. Trend data can be scrolled backward and forward. Gaps in trend data may correspond to times that the system was placed in Monitor Standby status. To change the period of time viewed, the clinician touches anywhere in the trend window; a vertical reference line appears through the middle of the trend graphs and a dialog box is displayed.

The time position of the reference line is displayed at the bottom of the trend display as shown in the example in Figure 8-8. The data values shown for each trended parameter correspond to the time position of the reference line. There are no units of measure labeled in the trend window.

There are two pages of trend data available for viewing as well as a third page where the clinician can configure a custom trend display of up to four parameters. See “Creating a Custom Trend Page” on page 8-10 for complete information.



Figure 8-8. Lung Compliance Trend with Reference Line, Time Position, and Numerics

Trend Scale

The trend scale depends on the data it represents. The following table presents the scale limits for each parameter trended; the scale cannot be changed. Invalid data appears as a gap in trend graphs.

Note: For trend scales for parameters monitored by the Integrated Patient Monitor, see the *Operator's Instruction Manual for the Integrated Patient Monitor Option*.

Parameter	Scale min/max displayed in trend
Page 1	
Breathing Pressure - Peak/Mean/Plateau/PEEP	-10/100 cmH ₂ O
Minute Volume	0/30 L
Agent (Primary) Inspired/Expired	0/9.0% except Desflurane 0/20.0%
CO ₂ Inspired/End Tidal	0.0/10.0%, 0.0/10.0 kPa, 0/76 mmHg
O ₂	0/100%
Lung Compliance	0.0/150.0 mL/cmH ₂ O
Page 2	
MAC	0/3.5
Respiration Rate	0/20/70 BPM
Fresh Gas Flow - Air	0/10 L/min
Fresh Gas Flow - O ₂	0/10 L/min
Fresh Gas Flow - N ₂ O	0/10 L/min
Fresh Gas Flow - Total	0/20 L/min
Inspired N ₂ O	0/100%
Page 3 - Custom Trend	

Trend Display Adjustments

When the clinician touches the trend window, a trend dialog box appears. It allows the clinician to scroll the trend forward or backward in time, to view other pages of trend data, and to jump to a custom trend display page.



Figure 8-9. Trend Dialog Box

Smooth Scroll/ Jump Scroll

A choice of scroll control buttons moves a vertical reference line in the middle of the graphical trend display. **Smooth Scroll** moves the line in one-minute segments and **Jump Scroll** in 20-minute segments. Touching the left arrow [◀] moves the reference line backward in time or to the beginning of the trend record. Touching the right arrow [▶] moves the reference line forward in time.

Note: If the vertical cursor gets to the end of data, touching the arrow buttons has no effect.

Trend Page

Use the **[Previous]** and **[Next]** buttons to view preceding or succeeding pages of trend data.

Note: The last page of the trend display is the custom trend page. See “Creating a Custom Trend Page” on page 8-10 for more information.

Jump to
Custom Trend

The **[Jump to Custom Trend]** button allows the clinician to go directly to the custom trend page from any currently displayed trend page. It is a quick way to access the custom trend page without having to page through the other trend data. See “Creating a Custom Trend Page” below for more information.

Exit

Touching the **[Exit]** control button or touching the trend window itself closes the trend dialog box and removes the vertical reference line.

Creating a Custom Trend Page

Use the following procedure to create a custom page of up to four trends.

1. In the trend dialog box, touch the **[Jump to Custom Trend]** button or touch the **[Next]** button until the custom trend page is displayed as shown in Figure 8-10.
2. Touch the **[Config]** button to enter a configuration mode. Four selection buttons appear on the screen: **[Trend 1]**, **[Trend 2]**, **[Trend 3]**, and **[Trend 4]**. See Figure 8-11.

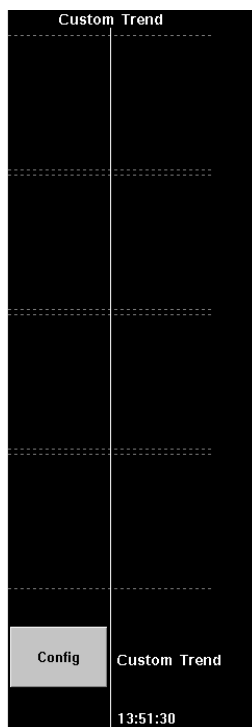


Figure 8-10. Custom Trend Page

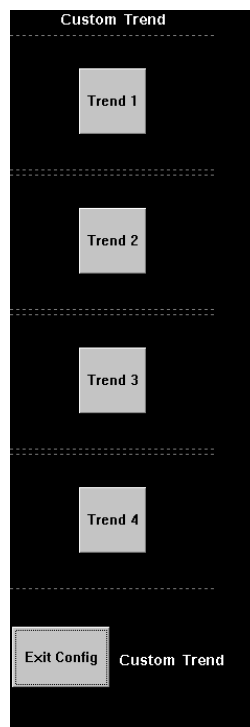


Figure 8-11. Trend Selection Controls

3. Touch the appropriate button for the trend to be configured. A trend select dialog box appears showing all available parameter choices.

Note: The following parameters are not available for the custom trend: ventilator settings, ventilator modes, and secondary agent.

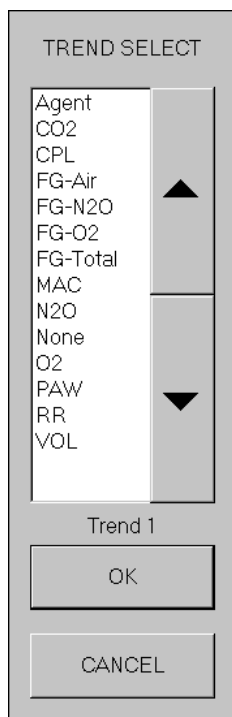


Figure 8-12. Trend Select Dialog Box

4. Select the desired parameter for the custom trend. Use the arrow keys to view parameters currently off the screen.
 - Touch the **[OK]** button to confirm the selection
 - Touch the **[Cancel]** button to cancel the selection
5. Repeat the procedure for the remaining custom trends. When all trends have been configured, touch the **[Exit Config]** button to exit the trend configuration mode.

Clear Trends

All accumulated data from the trend window, the data log, and the alarm log can be deleted. Touch **[Clear Trends]** in the main screen taskbar to open a dialog box for selecting this function.

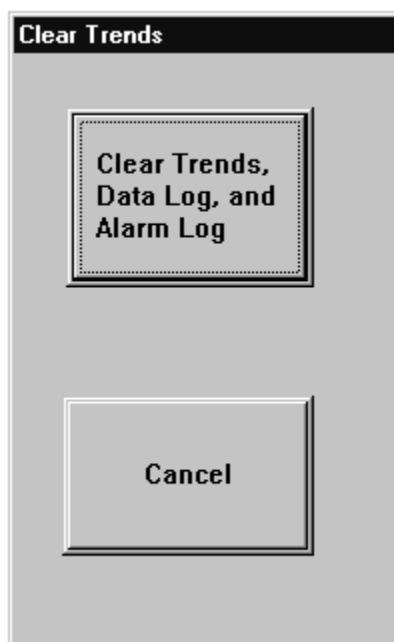


Figure 8-13. Clear Trends, Data Log, and Alarm Log Dialog Box

Touch **[Clear Trends, Data Log, and Alarm Log]** to remove all trend data immediately from these sources. Cleared data cannot be recovered.

Touch **[Cancel]** to resume trend recording without deleting the accumulated data.

Data Log

Data log data can be recorded in 1, 2, 5, or 10-minute intervals. The interval and other data log display features can be customized by the clinician (see *Data Log Control Notebook* later in this section).

To view the data log, touch **[Data Log]**. The data log spreadsheet appears on the screen, partially overlaying the waveform display:

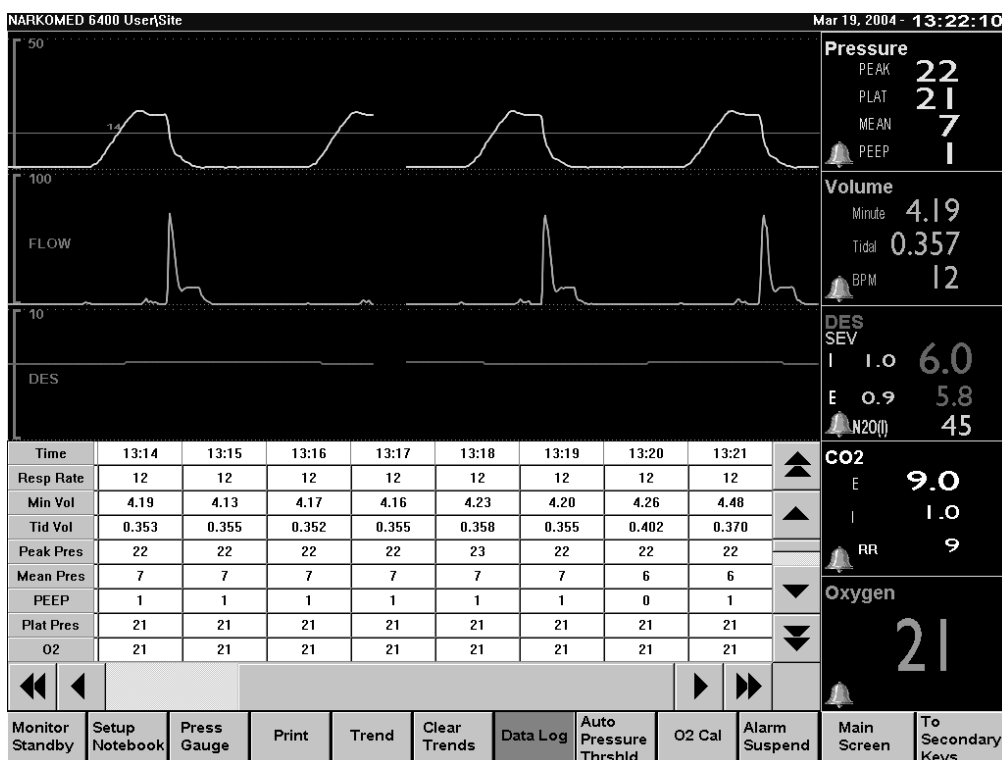


Figure 8-14. Data Log (Horizontal Orientation with Time on Top)

The data log window tracks the following measures:

Data Log Entry	Monitoring Measure
Time	time readings were taken
Resp Rate	respiratory rate (BPM) (from volume)
Min Vol	minute volume (liters)
Tid Vol	tidal volume (liters)
Peak Pres	peak pressure (cmH ₂ O)
Mean Pres	mean pressure (cmH ₂ O)
PEEP	PEEP (cmH ₂ O)
Plat Pres	Plateau Pressure (cmH ₂ O)

Data Log Entry	Monitoring Measure
O2	oxygen concentration (percent) readings
Agt (1) I:E	primary agent inspiratory and expiratory concentration (percent) readings
Agt (2) I:E	secondary agent inspiratory and expiratory concentration (percent) readings.
MAC	MAC value based on detected agent type
ET CO2	end tidal carbon dioxide concentration readings in the currently selected units
INSP CO2	inspiratory carbon dioxide concentration readings in the currently selected units
N2O (I)	inspiratory nitrous oxide (percent) readings
Vent Mode	ventilator mode setting
Vt Set	ventilator tidal volume setting (mL) (logged in Volume mode only)
Rate Set	ventilator breathing rate setting (bpm) (logged in Volume and Pressure modes only)
SIMV Rate	ventilator breathing rate setting (bpm) (logged in SIMV mode only)
I:E Ratio*	inspiratory/expiratory ratio (logged in Volume, Pressure, and SIMV modes only)
Pmax	maximum ventilator pressure setting (cmH ₂ O) (logged in Volume mode only)
PSet	peak ventilator airway pressure setting (cmH ₂ O) (logged in Pressure mode only)
PEEP Set	ventilator PEEP setting (cmH ₂ O) (logged in Volume, Pressure, and SIMV modes only)
Insp Pause	ventilator inspiratory pause setting (%) (logged in Volume and SIMV modes only)
Insp Flow	ventilator inspiratory flow rate setting (L/min) (logged in Pressure mode only)
FG Flow Air	fresh gas flow for air (L/min)
FG Flow N2O	fresh gas flow for nitrous oxide (L/min)
FG Flow O2	fresh gas flow for oxygen (L/min)
FG Flow Total	total fresh gas flow for all gases (L/min)

*the I:E Ratio setting displayed in the data log may differ from the ventilator setting by ± 0.2 .

Note: For a list of data log entries monitored by the Integrated Patient Monitor, see the *Operator's Instruction Manual for the Integrated Patient Monitor Option*.

- To view any data log entries currently off the screen, touch any of the vertical or horizontal scroll controls.
- To highlight one or more rows or columns of data, touch the corresponding time stamps. To remove the highlighting, touch again.
- To clear the data log, touch **[Clear Trends]**, and then touch **[Clear Trends, Data Log, and Alarm Log]** in the confirmation dialog box that follows.
- To close the data log, touch **[Data Log]** or **[Main Screen]** while the data log spreadsheet is displayed.

If **[Trend]** is touched while the data log is displayed, part of the data log can be overlaid by the trend window. When the system is changed to **Monitor Standby** status, data log recording stops.

Data entries for cases considered inactive, i.e., no valid patient parameter data for three or more minutes, are displayed on the screen with a gray background.

Data Log Control Notebook

The data log control notebook allows the clinician to customize the data log display. It has two active tabs: **[Setup]** and **[Custom]**. To open the notebook, touch any part of the data log currently displayed on the screen, except for the time stamps. Touching the data log again closes the notebook.

Setup

Touch the **[Setup]** tab to view the data log control notebook setup page (note that it is the default page displayed when the notebook is first opened).

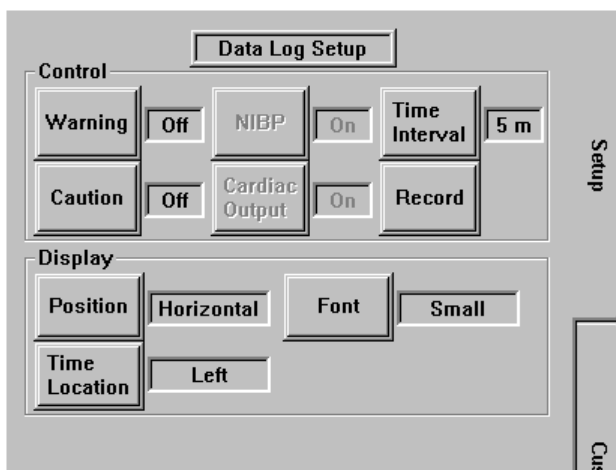


Figure 8-15. Data Log Control Notebook - Setup Page

Warning	<p>When this button is set to On, an entry is automatically made in the data log when a Warning is posted in the Alarm window. The corresponding time stamp in the data log is colored red.</p> <p>Touch the [Warning] button or its associated selection field to toggle the setting On or Off.</p>
Caution	<p>When this button is set to On, an entry is automatically made in the data log when a Caution is posted in the Alarm window. The corresponding time stamp in the data log is colored yellow.</p> <p>Touch the [Caution] button or its associated selection field to toggle the setting On or Off.</p>
Time Interval	<p>Touch the [Time Interval] button or its associated selection field until the preferred setting is displayed. The interval can be set to 1, 2, 5, or 10 minutes.</p> <p><i>Note:</i> The data log records available patient data every 60 seconds, regardless of the time interval setting. The time interval simply filters the data displayed to the clinician.</p>
Record	<p>Touch the [Record] button to log an entry on demand. An entry will be made in the data log at that moment, regardless of the interval setting.</p>
Position	<p>This option allows the clinician to display the data log in either a vertical orientation, where the data log is displayed vertically over the right side of the waveform display (see Figure 8-16), or in a horizontal orientation, where the data log is displayed across the bottom of the waveform display (see Figure 8-14).</p> <p>Touch the [Position] button or its associated selection field to toggle the setting between [Vertical] and [Horizontal].</p>
Time Location	<p>This option allows the clinician to display the time stamps either in a column on the left side of the data log (as shown in Figure 8-16), or as a row across the top of the data log (as shown in Figure 8-14).</p> <p>Touch the [Time Location] button or its associated selection field to toggle the setting between [Left] and [Top].</p> <p><i>Note:</i> When the time stamps are displayed in a column on the left side of the data log, the column widths are automatically resized to the minimum widths needed to accommodate the column titles or data.</p> <p>When the time stamps are displayed in a row across the top of the data log, columns widths remain uniform.</p>

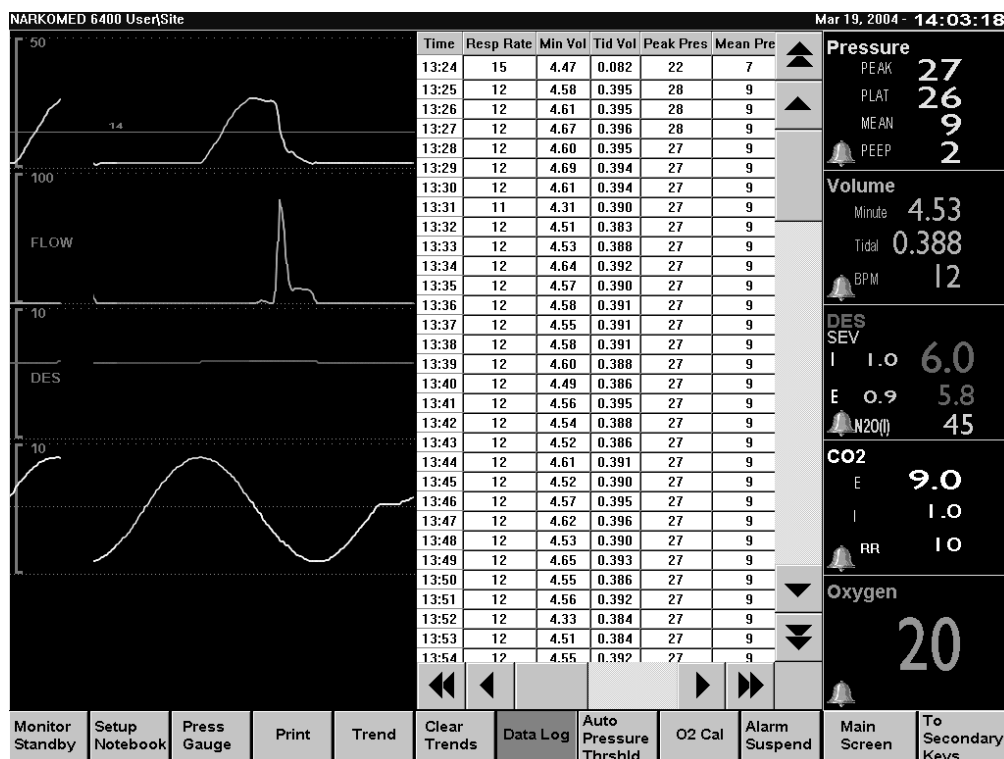


Figure 8-16. Data Log (Vertical Orientation with Time on Left)

Font

This option allows the clinician to change the font size used to display the data log on the screen.

Touch the **[Font]** button or its associated selection field until the preferred setting is displayed. The available settings are: **[Small]** (8 pt.), **[Medium]** (12 pt.), and **[Large]** (16 pt.).

Note: The **[NIBP]** and **[Cardiac Output]** control buttons are enabled only if the Narkomed 6400 is configured with an Integrated Patient Monitor. For complete information, see the *Operator's Manual for the Integrated Patient Monitor (IPM) Option*.

Custom

Touch the **[Custom]** tab to view the data log control notebook custom page.

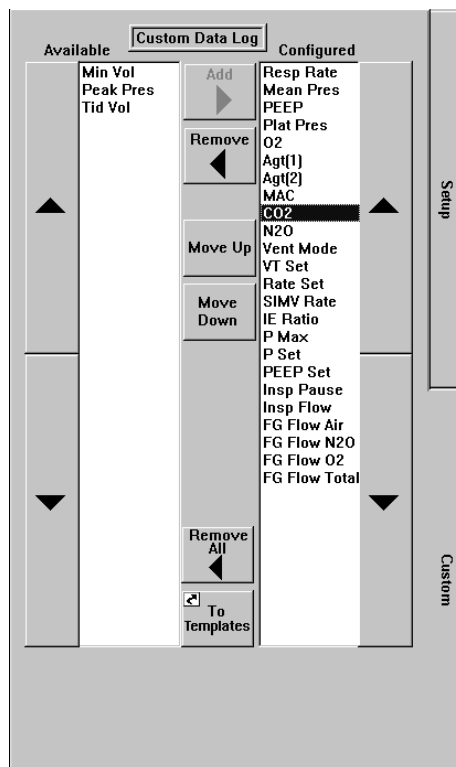


Figure 8-17. Data Log Control Notebook - Custom Page

This page allows the clinician to select the parameters that will be displayed in the data log and the order in which they appear. The Available column contains an alphabetical list of all parameters available for display, while the Configured column shows the parameters that will actually be displayed once the custom configuration is completed.

All available patient data is recorded every 60 seconds, regardless of the configured settings. Removing a configured parameter from the list simply “hides” it from the clinician.

The order of the parameters in the Configured column (top to bottom) determines the order in the displayed data log (top to bottom and left to right, depending on the Time Location selection). The various control buttons on the page are used to navigate through the lists, to move parameters between the Available and Configured lists, and to save the Configured list to a template.

Note: Certain parameters cannot be configured individually. They are grouped as follows and can be configured only as part of that group:

Note: The last four parameter groups in the list below are available only if the Narkomed 6400 is configured with an Integrated Patient Monitor.

- ET CO₂/Insp CO₂ data
- IBP Systolic/Diastolic/Mean data (configurable on a per channel basis)
- NIBP Systolic/Diastolic/Mean data
- Cardiac Output/Blood Temperature data
- SpO₂ Saturation/Pulse data

Add

This control button is used to add parameters to the Configured list, i.e., parameters to be displayed in the data log. The button is disabled when no parameters are selected in the Available list or when the Available list is empty.

To add a parameter:

1. Touch the parameter in the Available list window. Use the adjacent arrow buttons to view any parameters currently off the screen.
2. Touch **[Add]**. The parameter is added to the end of the Configured list and appears immediately in the data log window.

Remove

This control button is used to remove parameters from the Configured list, i.e., to remove parameters from the displayed data log. The button is disabled when no parameters are selected in the Configured list or when the Configured list is empty.

To remove a parameter:

1. Touch the parameter in the Configured list window. Use the adjacent arrow buttons to view any parameters currently off the screen.
2. Touch **[Remove]**. The parameter is moved from the Configured list to the Available list and is removed immediately from the data log window.

Move Up

This control is used to move a parameter up the Configured list, i.e., move it up or left one position in the displayed data log (depending on the Time Location selection). The button is disabled if no parameters are highlighted in the Configured list or if the topmost parameter is highlighted.

1. Touch the parameter in the Configured list window. Use the adjacent arrow buttons to view any parameters currently off the screen.
2. Touch **[Move Up]**. The selected parameter moves one position up in the Configured list, and one position up or one position left (depending on the Time Location selection) in the displayed data log.

Move Down

This control is used to move a parameter down the Configured list , i.e., move it down or right one position in the displayed data log (depending on the Time Location selection). The button is disabled if no parameters are highlighted in the Configured list or if the bottommost parameter is highlighted.

1. Touch the parameter in the Configured list window. Use the adjacent arrow buttons to view any parameters currently off the screen.
2. Touch **[Move Down]**. The selected parameter moves one position down in the Configured list, and one position down or one position right (depending on the Time Location selection) in the displayed data log.

Remove All

Use this control button to remove all parameters from the Configured list and the displayed data log.

1. Touch **[Remove All]**. The confirmation dialog box shown in Figure 8-18 is displayed on the screen.

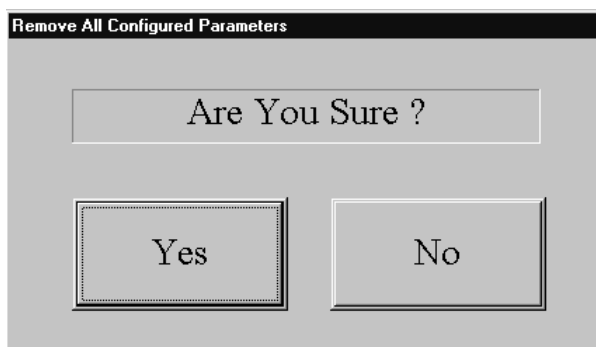


Figure 8-18. Remove All Configured Parameters Confirmation Dialog Box

- Touch **[No]** to remove the dialog box from the screen without deleting the parameters
- Touch **[Yes]** to continue; all parameters are removed from the Configured list and the displayed data log, and the **[Add]**, **[Remove]**, **[Move Up]**, **[Move Down]**, and **[Remove All]** buttons are disabled

To Templates

Touch **[To Templates]** to open the Template page of the System Setup Notebook.

This button provides a convenient shortcut to access the Template page and reminds the clinician to save the Configured list. For complete information on the use of templates, see “Template” on page 3-19.

Ending a Case

If no other cases are expected during the next several hours, turn the main switch to **STANDBY**. This will power the system down.

Note: This step initiates a complete system reset and calibration. See “Start-up Screen” on page 3-2 and “Ventilator Self-Test” on page 3-4 for a complete description. If the system reset prompt dialog box were to appear, it would mean that the machine had been running continuously for 30 days. See “System Reset and Calibration” on page 3-5.

If another case is likely during the next several hours, follow the steps below:

1. Put the ventilator in **Ventilator Standby** by touching the **[Standby]** control button on the ventilator control panel. See “Putting the System in Ventilator Standby” on page 23 in this section. Monitor Standby cannot be entered unless the ventilator is in Ventilator Standby.

Warning: Once the patient is disconnected from the Narkomed 6400, be sure that the fresh gas is adjusted to minimum O₂ flow. In addition to wasting gas, high fresh gas flow for extended periods with no patient attached may dry out the absorbent. Excessively dry absorbent can break down anesthetic agent and produce potentially toxic compounds.

2. Touch the **[Monitor Standby]** button and confirm. See “Putting the System in Monitor Standby” on page 2 in this section.

Service Interruptions

Warning: Prior to moving the Narkomed 6400, as outlined below, ALL extraneous equipment, (monitors, recorders, third party equipment etc.) must be removed from the top shelf of the NM6400.

Powering Down the System for Transport

If it becomes necessary to move the Narkomed 6400 or to take it out of service, the following procedure is recommended.

1. Turn the main switch to **STANDBY** position.
2. Unplug the AC power cord from the outlet.

Moving the System in an Emergency

However, if the Narkomed 6400 must be moved for immediate use during an emergency, the following procedure is recommended.

Caution: Do not turn the main switch to **STANDBY** position.

1. Put the monitor and ventilator in **STANDBY** mode:
 - a. Press the **[Standby]** button on the ventilator control panel and confirm. See “Putting the System in Ventilator Standby” on page 23 below. Monitor Standby cannot be entered unless the ventilator is in Ventilator Standby.
 - b. Touch the **[Monitor Standby]** button and confirm. See “Putting the System in Monitor Standby” on page 2 in this section.
2. Unplug the AC power cord.
3. Move the system to its new location.
4. Plug the AC power cord into an AC outlet.

The Narkomed 6400 is now ready for use.

Note: This procedure is only for emergency use. If the AC power cord is not plugged in, battery drain will occur until the battery is fully discharged. Only use this method to move the system when no time is available to shut down and go through the diagnostics again.

Note: Powering up the Narkomed 6400 in a cold start-up (where the system power switch has been set to **STANDBY** for more than four minutes), requires approximately 5 minutes, including ventilator self-test, provided operator responses to ventilator prompts are immediate. Power-up diagnostics of the monitoring systems and ventilator self-test are required for operation.

Caution: Moving the Narkomed 6400 by pushing or pulling on the APL valve (pop-off valve) may cause damage to ventilator connections or the valve itself. Use only the push-pull bar when moving the machine.

Putting the System in Ventilator Standby

Set the ventilator to **Ventilator Standby** after each case. Using **Ventilator Standby** status is recommended for the most efficient and cost-effective use of the ventilator. The ventilator is powered through the Narkomed 6400 and cannot be powered off independently.

Warning: Assisted ventilation is not possible while in **Ventilator Standby** status. Never change to **Ventilator Standby** with a patient attached.

Ventilator Standby provides the following features:

- the system can be returned immediately to any operating mode
- ventilation gas consumption stops
- power consumption is minimal
- the piston assembly and compact breathing system can be removed for cleaning or service.

Note: When the piston assembly and compact breathing system are installed, any respiration detected in **Ventilator Standby** status immediately activates an auto wake-up feature and causes the ventilator to change to Manual/Spontaneous Mode.

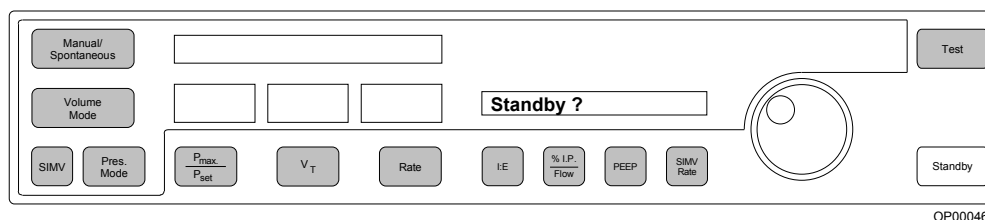


Figure 8-19. Putting Ventilator in Ventilator Standby Status

To set the ventilator to **Ventilator Standby** status:

1. Press the **[Standby]** control button.
2. The ventilator will display **Standby ?**.
3. Press the selector knob to confirm. One of the following will occur:
 - if the total fresh gas flow is one liter per minute or less, the ventilator changes to **Ventilator Standby** and **Standby** is displayed on the ventilator control panel. A **VENT STANDBY** advisory is displayed on the monitor.
 - if the total fresh gas flow is greater than one liter per minute, the system displays the confirmation dialog box shown in Figure 8-20.

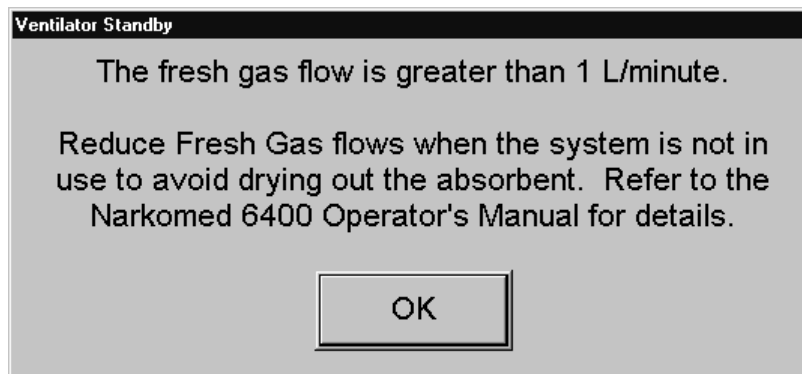


Figure 8-20. Ventilator Standby Confirmation Dialog Box - Fresh Gas Flow >1 L/min

To continue, touch the **[OK]** button or reduce the fresh gas flow to below one liter per minute. The ventilator changes to **Ventilator Standby** and **Standby** is displayed on the ventilator control panel. A **VENT STANDBY** advisory is displayed on the monitor.

Replacing Absorbent Between Cases

The soda lime changes color from the bottom upwards when saturated with CO₂. Check the absorbent manufacturer's literature for specific signs that indicate CO₂ saturation. The soda lime must be changed when two-thirds of the charge has changed color. The color may also fade again due to drying out after prolonged breaks.

Warning: Change the absorbent if fresh gas has flowed continuously without the use of the Narkomed 6400 on patients (e.g., if machine has been left on over a weekend).

Additionally, it has been observed that excessively dry absorbent can react chemically with inhalation anesthetics (especially sevoflurane), resulting in the breakdown of the anesthetic.

1. Turn off the vaporizer.
2. Turn off fresh gas delivery.
3. Press **[Manual/Spontaneous]** on the ventilator control panel, and confirm.
4. Set the APL valve to **Spont** position.
5. Turn the absorbent canister clockwise (viewed from above) until it is free of the ventilator.
6. Empty the contents into an appropriate refuse container.
7. Check the canister to ensure it is not chipped or cracked and that the screen at the bottom is still in place.

8. Add new absorbent to the canister.

Fill the canister to the maximum fill line. Do not fill above the line located about a quarter-inch from the top of the canister. The clearance and the ratio of canister diameter to screen opening minimizes the potential for channeling. Be sure that the top edge of the canister is clean of any absorbent particles.

9. Replace the canister in the proper position underneath the ventilator and turn counterclockwise as far as possible.
10. Run through the leak and compliance test on the ventilator to check for leaks. See "Ventilator Leak and Compliance Test" on page 7-19 for details.

Ventilator Safe State

The ventilator automatically enters a safe state if it detects an internal fault which might affect patient safety. The clinician is alerted that safe state has been initiated when the ventilator momentarily displays **Equipment fault** and then a fault number on the control panel. The ventilator buzzer sounds continuously until silenced by pressing the selector/confirmation knob or removing power to the unit.

The ventilator now performs as in Manual/Spontaneous Mode.

1. Set the APL valve to **Man** position.
2. Adjust the APL pressure limit for the desired inspiratory plateau pressure.
3. Press the O₂ flush button on the Narkomed 6400 as required to sufficiently inflate the breathing bag.
4. Manually ventilate the patient by squeezing the breathing bag.

Note: In safe state the ventilator piston assembly position is not locked, as in Manual/Spontaneous Mode. As a result, airway pressure may initially push the piston back to its limit stop, increasing the volume of the breathing circuit and depleting the volume of the breathing bag. It may be necessary to press the O₂ flush button again to reinflate the breathing bag.

5. Contact an authorized representative of DrägerService before attempting to reuse the ventilator.

Ventilator Override

A ventilator override switch is provided for use in the unlikely event of a fault which does not allow the clinician to ventilate a patient in normal Manual/Spontaneous Mode or safe state. Narkomed 6400 respiratory monitoring will be unaffected.

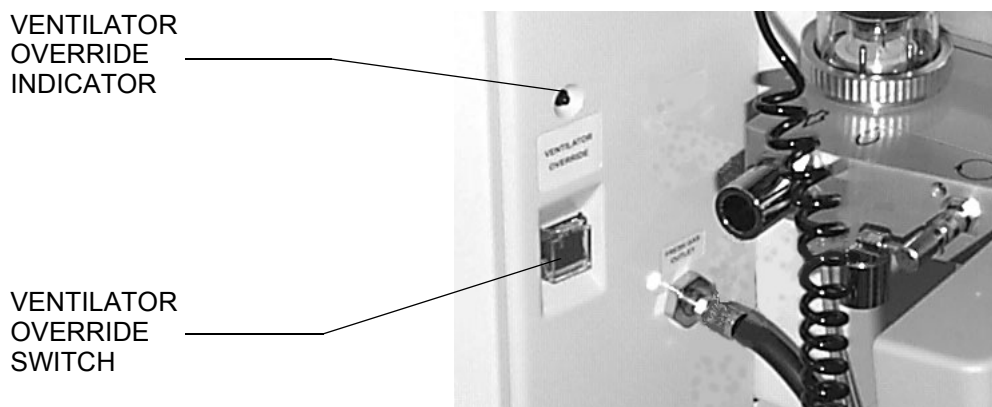


Figure 8-21. Location of Ventilator Override Switch

1. Locate the ventilator override switch above the breathing system interface panel.
2. Depress the switch until the indicator lights.

The ventilator now performs as in Manual/Spontaneous Mode. When in ventilator override condition, no information is displayed on the ventilator control panel.

3. Set the APL valve to **Man** position.
4. Adjust the APL pressure limit for the desired inspiratory plateau pressure.
5. Press the O₂ flush button on the Narkomed 6400 as required to sufficiently inflate the breathing bag.
6. Manually ventilate the patient by squeezing the breathing bag.

Note: In ventilator override situation the ventilator piston assembly position is not locked, as in Manual/Spontaneous Mode. As a result, airway pressure may initially push the piston back to its limit stop, increasing the volume of the breathing circuit and depleting the volume of the breathing bag. It may be necessary to press the O₂ flush button again to reinflate the breathing bag.

7. Contact an authorized representative of DrägerService before attempting to reuse the ventilator.

Note: If activated inadvertently, ventilator override may be reset by switching the Narkomed 6400 to **System Standby** and then turning it on again.

Operating during a Power Failure

During a power failure, the Narkomed 6400 battery backup will ensure continued operation for a minimum of 30 minutes. Even after the Narkomed 6400 batteries are depleted, the ventilator can continue to be used to ventilate the patient in Manual/Spontaneous Mode.

Use of Suction with the Narkomed 6400

Whenever suction is applied to a patient, the minimum suction required to achieve the desired effect should be used. If a high degree of suction is applied to the patient's airway *while the breathing circuit is connected*, the potential exists to trap vacuum in the ventilator breathing circuit which will prevent both mechanical and manual ventilation. This can occur by applying suction to a gastric tube that has inadvertently been placed in the trachea, or by suctioning the airway through an airway adapter such as prior to or during bronchoscopy.

When vacuum is trapped in the breathing system, the ventilator will stop and display a message on the ventilator control panel which says either **Resetting piston** or **Breath Sys. fail**. The ventilator will not be able to complete the reset operation when this occurs until the vacuum is relieved.

TO PREVENT THE VENTILATOR FROM STOPPING DUE TO EXCESSIVE NEGATIVE PRESSURE, FOLLOW THESE GUIDELINES WHENEVER THE POSSIBILITY EXISTS OF APPLYING SUCTION TO THE AIRWAY WITH THE BREATHING CIRCUIT ATTACHED:

1. Always use regulated suction set to the minimum level needed to achieve the desired effect.
2. Place the ventilator in Manual/Spontaneous mode.
3. Inflate the reservoir bag using the oxygen flush button, if not currently inflated.
4. Monitor the reservoir bag, and immediately remove the vacuum source if the reservoir bag begins to deflate. (It should not be possible to draw a strong vacuum level on the airway unless the reservoir bag is completely collapsed.)

The Narkomed 6400 has help screens to assist the clinician in the case where negative pressure has been applied to the airway. For more information, see "Negative Pressure Dialog Box" on page 9-33 and corrective action for **Breath Sys. fail** on page 9-25.

Operation during Cardiac Bypass

When the Narkomed 6400 is used during cardiopulmonary bypass, the following procedures are recommended:

1. If no pressure is desired to be maintained on the lungs, place the ventilator in Manual/Spontaneous mode with the APL valve set for spontaneous (**Spont**) ventilation.
2. If the clinician's practice is to maintain pressure throughout cardiopulmonary bypass, this can be done in the usual fashion by placing the ventilator in Manual/Spontaneous mode with the APL valve set for manual (**Man**) ventilation. The clinician should then adjust fresh gas flow and the APL valve setting as appropriate.

The pressure level achieved will be determined by the total fresh gas flow, the setting on the APL valve, and the gas analyzer sample flow.

The [**Alarm Suspend**] control button at the bottom of the display can be used to silence alarms until ventilation is reinitiated. While alarms are suspended, the pressure in the circuit can continue to be monitored by displaying the software pressure gauge.

Warning: Never change to **Ventilator Standby** with a patient attached.

9

Messages/Problem Resolution

This section describes the alarm notification structure and lists all potential Narkomed 6400 monitoring alarms and ventilator control panel messages, including status messages, operator prompts, and alarms. Descriptions of problem resolution follow the appropriate monitoring alarms.

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Alarm Structure

Alarms are organized into three categories based on urgency – warnings, cautions, and advisories. Alarm messages appear in the order of urgency, each with a different colored background. Within each priority, they are listed in order of occurrence with the most recent message at the top. Three distinct sound patterns announce the three types of alarm messages. The clinician may set the loudness of “full” volume of the tone during system configuration; see “Silencing Audible Alarms” on page 3-57. When more than one alarm condition occurs, only the highest priority alarm sounds.

Warnings

Warnings are the highest priority alarms and require an immediate response.

New warning messages are displayed on a flashing red background with white text. The flashing stops when the **[ALARM SILENCE]** control button in the alarm window is pressed.

The flashing stops for the duration of the silence period and the text is white on a red background.

Warnings are announced by a three-tone sequence (HIGH-HIGH-LOW).

Tone	Volume	Pause
1st	full volume	6 seconds
2nd	1/3 volume	5 seconds
3rd	2/3 volume	4 seconds
4th, etc.	full volume	3 seconds; alarm sounds full volume in 3-tone bursts until condition is resolved or [ALARM SILENCE] control button is activated, when possible.

Cautions

Cautions are medium priority alarms and require a prompt response.

New caution messages are displayed on a flashing yellow background in black text. The flashing stops when the **[ALARM SILENCE]** control button in the alarm window is pressed.

The flashing stops for the duration of the silence period and the text is black on a yellow background.

Caution messages are announced by 3-tone bursts (LOW-LOW-HIGH) at full volume every 30 seconds.

Advisories

Advisories are the lowest priority alarms and require the clinician's awareness.

Advisory messages are displayed on a white background with black text and do not flash.

Depending on the urgency, a single tone may sound when an advisory condition occurs.

For a complete list of messages, see "Summary of Alarm Messages and Indicators" on page 13 in Appendix 1.

Pressure Monitoring

Summary of Pressure Alarms

The following tables contain all warning, caution, and advisory alarms associated with breathing pressure monitoring.

Note: This summary assumes that the patient's condition is checked before attempting to change any system settings when patient condition alarms occur.

Pressure Monitoring Warnings

Message	Condition
APNEA-PRESSURE	<p>When the ventilator is in Volume, Pressure or SIMV (SIMV rate \geq 6) Mode:</p> <p>If the breathing pressure remains below the threshold pressure for 15 seconds longer than the caution condition (30 seconds total), the caution message APNEA-PRESSURE is upgraded to a warning on the central alarm display, and a continuously repeating audible alarm sounds. During the warning condition, numeric data remains on the display as long as the monitor detects a peak pressure at least 10 cmH₂O greater than PEEP pressure.</p> <p>When the ventilator is in Manual/ Spontaneous or SIMV (SIMV rate <6) Mode:</p> <p>The warning condition does not occur until 60 seconds have elapsed.</p>
CONTINUOUS PRES	<p>The measured breathing pressure has remained above the threshold pressure alarm limit for more than 15 seconds. The breathing pressure display area is blanked momentarily. As soon as the measured breathing pressure drops below the threshold pressure alarm limit, alarm annunciation ceases.</p> <p>This alarm is suppressed during ventilator self-tests.</p>
SUB ATM PRES	<p>The measured breathing pressure has fallen below -10 cmH₂O. This alarm condition is cleared when the sensed pressure rises above -10 cmH₂O. However, the alarm message remains displayed for 5 seconds.</p>
VENT PRES HI	<p>The sensed breathing pressure exceeded the high pressure limit. This alarm condition is cleared as soon as the measured breathing pressure drops below the high pressure alarm limit. However, the alarm message remains displayed for 5 seconds.</p>

Pressure Monitoring Cautions

Message	Condition
APNEA-PRESSURE	<p>When the ventilator is in Volume, Pressure or SIMV (SIMV rate \geq 6) Mode:</p> <p>If the measured breathing pressure remains below the threshold pressure alarm limit for more than 15 seconds, the caution message APNEA-PRESSURE appears on the central alarm display and an intermittent audible alarm sounds.</p> <p>When the ventilator is in Manual/ Spontaneous or SIMV (SIMV rate < 6) Mode:</p> <p>The caution condition does not occur until 30 seconds have elapsed.</p>
PEEP > 25	<p>The monitor has sensed a PEEP of 26 cmH₂O or greater. Alarm annunciation ceases as soon as the measured PEEP drops below 26 cmH₂O. Also, a pressure apnea warning or continuing pressure alarm condition clears this alarm condition.</p>

Pressure Monitoring Advisories

Message	Condition
PEEP HIGH	The monitor has sensed a PEEP greater than the PEEP high alarm limit. As soon as the measured PEEP drops below the alarm limit, the advisory message disappears.
PRESSURE LIMIT	Pressure limit reported by the ventilator AND the measured tidal volume is less than 85% of the ventilator tidal volume set point.
P-SET NOT MET	Pset not delivered by ventilator. The alarm is activated when the breathing pressure peak is 6 cmH ₂ O below Pset (Pset 10-30 cmH ₂ O), 8 cmH ₂ O below Pset (Pset 31-50 cmH ₂ O), or 10 cmH ₂ O below Pset (Pset 51-70 cmH ₂ O). <i>Note:</i> This alarm is available only in Pressure mode.
THRESHOLD LOW (this message is displayed in the breathing pressure parameter box)	The current threshold pressure alarm limit is 4 cmH ₂ O or more below the optimal threshold position.

Pressure Monitoring Problem Resolution

Problem	Possible Cause	Remedy
No pressure readout in display area during ventilation	Pilot line not connected	Make sure pilot line is properly connected.
	Pilot line blocked or kinked	Make sure that lumen of pilot line is free of obstructions.
Only peak value is displayed while ventilator is in Manual/ Spontaneous Mode	Flow sensor not installed in expiratory limb	Ensure flow sensor is properly installed to the expiratory valve.
	Flow sensor cable is disconnected	Ensure flow sensor cable is connected.

Volume Monitoring

Summary of Volume Alarms

The following tables contain all warning, caution, and advisory alarms associated with respiratory volume monitoring.

Note: This summary assumes that the patient's condition is checked before attempting to change any system settings when patient condition alarms occur.

Volume Monitoring Warnings

Message	Condition
APNEA-VOLUME	<p>When the ventilator is in Volume, Pressure or SIMV (SIMV rate \geq 6) Mode:</p> <p>If a valid breath is not detected for 15 seconds longer than the caution condition (30 seconds total), the caution message APNEA-VOLUME is upgraded to a warning and the respiratory volume measurement is blanked.</p> <p>As soon as a valid breath is detected, alarm annunciation ceases and a tidal volume measurement appears in the display window.</p> <p>When the ventilator is in Manual/ Spontaneous or SIMV (SIMV rate < 6) Mode:</p> <p>The warning condition does not occur until 60 seconds have elapsed.</p> <p>Note: Volume-related alarms can be disabled with the volume alarm bell. The expiratory flow in the patient breathing system is continuously monitored. By processing the expiratory flow pattern, the monitor can determine if a "valid" breath has occurred.</p>

Volume Monitoring Cautions

Message	Condition
APNEA-VOLUME	<p>When the ventilator is in Volume, Pressure or SIMV (SIMV rate \geq 6) Mode:</p> <p>If a valid breath is not detected for an interval of 15 seconds, the caution message APNEA-VOLUME appears on the central alarm display.</p> <p>When the ventilator is in Manual/ Spontaneous or SIMV (SIMV rate $<$ 6) Mode:</p> <p>The caution condition does not occur until 30 seconds have elapsed.</p>
MIN VOL LOW	A minute volume less than the low minute volume alarm limit has been measured.

Volume Monitoring Advisories

Message	Condition
REVERSE FLOW	A reverse flow in excess of threshold has been detected. The threshold is 20 mL ($V_T \geq 50$ mL) and 9 mL ($V_T < 50$ mL). A forward flow clears the alarm condition. The REVERSE FLOW alarm message remains on screen for 5 seconds to allow recognition of an intermittent reverse flow condition.
SERVICE VOL	An internal electronic failure that would prevent proper operation, of the respiratory volume monitor has been detected.
TIDAL VOLUME LOW	<p>The patient's exhaled volume is more than 30% below the ventilator tidal volume setting. If this alarm occurs during a PRESSURE LIMIT and/or a FRESH GAS LOW alarm condition, it indicates that the patient's exhaled volume is more than 15% below the ventilator setting. The measured tidal volume used for comparison is compensated for hose compliance.</p> <p><i>Note:</i> This alarm is available only in Volume mode and SIMV mode.</p>

**Volume
Monitoring
Problem
Resolution**

Message	Condition
VOL SENS ERR	An error has occurred with the flow sensor.
VOL SENSOR DISC	The flow sensor cord is not properly connected to the respiratory volume input receptacle on the Narkomed 6400 (or the cord is damaged enough to cause an open circuit).

Problem	Possible Cause	Remedy
Blank display area	Apnea condition	Correct apnea condition. Ensure flow sensor is properly installed onto the expiration port.
Blank display area, VOL SENSOR DISC alarm message on alarm display	Sensor cord disconnected	Reconnect flow sensor cord plug to interface panel on Narkomed 6400.
	Sensor cord damaged	Replace flow sensor assembly.
REVERSE FLOW alarm message on alarm display	Expiratory valve not closing completely during inspiration	Check expiratory valve disc and pins. Clean, repair, or replace expiratory valve.
	Defective flow sensor	Replace flow sensor assembly.
VOL SENS ERR	Flow electronics enclosure is not properly seated onto flow housing	Reseat the flow electronics enclosure to the flow housing and be sure it is locked in place. Contact an authorized representative of DrägerService if message persists.
SERVICE VOL	Sensor fault	Replace flow sensor assembly

Nitrous Oxide and Agent Monitoring

Summary of Agent Alarms

The following tables contain all warning, caution, and advisory alarms associated with agent monitoring.

Note: This summary assumes that the patient's condition is checked before attempting to change any system settings when patient condition alarms occur.

Agent Monitoring Warnings

Message	Condition
% (agent) HIGH	The detected percentage greatly exceeds the high alarm limit

Agent Monitoring Cautions

Message	Condition
% (agent) LOW	The detected percentage is below the low alarm limit
% (agent) HIGH	The detected percentage exceeds the high alarm limit
MAC HIGH	Total MAC value from all anesthetics and N ₂ O exceeds 3.0.

Agent Monitoring Advisories

Message	Condition
2ND AGENT	A second agent has been detected.
AGENT MIX	More than two anesthetic agents have been detected
AGT WARMUP	The gas analysis pod is warming up
LINE BLOCK	Air samples are not getting through the sample line to the gas analysis pod.
SERVICE GAP	The gas monitoring system needs service

**Agent
Monitoring
Problem
Resolution**

Problem	Possible Cause	Remedy
Inaccurate agent or N ₂ O detection	Loose sample line connections	Check the sample line connections
	Blocked sample line	Make sure the line is not blocked
	Fresh gas circuit leak	Check for leaks in fresh gas circuit, particularly at vaporizer mounts
Lower than expected agent concentration displayed on monitor (especially with normal CO ₂ and N ₂ O readings)	Excessively dry absorbent	Replace absorbent immediately
System cannot monitor gases	Equipment fault	Contact an authorized representative of DrägerService.

Carbon Dioxide Monitoring

**Summary of
CO₂ Alarms**

The following tables contain all warning, caution, and advisory alarms associated with CO₂ monitoring.

Note: This summary assumes that the patient's condition is checked before attempting to change any system settings when patient condition alarms occur.

CO₂ Monitoring Warnings

Message	Condition
APNEA-CO2	<p>When the ventilator is in Volume, Pressure or SIMV (SIMV rate \geq 6) Mode:</p> <p>A warning alarm is activated after the caution alarm when apnea is detected for 30 seconds.</p> <p>When the ventilator is in Manual/ Spontaneous or SIMV (SIMV rate < 6) Mode:</p> <p>The warning condition does not occur until 60 seconds have elapsed.</p>

CO₂ Monitoring Cautions

Message	Condition
APNEA-CO2	<p>When the ventilator is in Volume, Pressure or SIMV (SIMV rate \geq 6) Mode:</p> <p>A caution alarm is activated when an apnea condition is detected for 15 seconds.</p> <p>When the ventilator is in Manual/ Spontaneous or SIMV (SIMV rate < 6) Mode:</p> <p>The caution condition does not occur until 30 seconds have elapsed.</p>
ET CO2 HIGH	The end tidal CO ₂ reading exceeds the high alarm limit.
ET CO2 LOW	The end tidal CO ₂ reading is below the low alarm limit.
INSP CO2 HIGH	The inspired CO ₂ reading exceeds the high alarm limit for three consecutive breaths.

CO₂ Monitoring Advisories

Message	Condition
AGT WARMUP	The gas analysis pod is warming up
CO2 ALARMS OFF	The CO ₂ alarm state is OFF.
LINE BLOCK	Air samples are not getting through the sample line to the gas analysis pod.
SERVICE GAP	The gas monitoring system needs service

Carbon Dioxide Monitoring Problem Resolution

Problem	Possible Cause	Remedy
Inaccurate readings	Loose sample line connections	Check the line connections
	Blocked sample line	Make sure the line is not blocked
System cannot monitor gases	Equipment fault	Contact an authorized representative of DrägerService.

Oxygen Monitoring

Summary of Oxygen Concentration Alarms

The following tables contain all warning, caution, and advisory alarms associated with oxygen monitoring.

Note: This summary assumes that the patient's condition is checked before attempting to change any system settings when patient condition alarms occur.

Oxygen Monitoring Warnings

Message	Condition
INSP O2 LOW	The measured inspiratory oxygen concentration has fallen below the low alarm limit.

Oxygen Monitoring Cautions

Message	Condition
O2 SUPPLY LOW	Oxygen supply to the Narkomed 6400 has fallen below 37 psi (\pm 3 psi).

Oxygen Monitoring Advisories

Message	Condition
CAL O2 SENSOR	Oxygen concentration greater than 110%.
INSP O2 HIGH	The measured inspiratory oxygen concentration has exceeded the high alarm limit.
O2 CAL DUE	The oxygen monitoring system has entered a noncalibrated state, or more than 18 hours have elapsed since the last calibration.
O2 CAL ERROR	<p>The difference between the outputs of the two sensor channels has exceeded the permissible percentage. (Checks are performed during oxygen calibration and monitoring.)</p> <p>OR</p> <p>During oxygen monitoring system calibration, the sensor's output voltage was not within the acceptable range. There are three possible causes for deviation from within this range:</p> <p><i>Exhausted sensor</i> - If the sensor's capacity is exhausted, its output voltage will not meet the required minimum.</p> <p><i>Incorrect environment</i> - If the sensor is exposed to an excessively rich or lean oxygen mixture during calibration, the sensor's output can either exceed or fall below the acceptable output range.</p> <p><i>Improper waiting period</i> - If the proper waiting period is not observed for a new sensor or for a sensor removed from the sensor housing, the sensor's output can either exceed or fall below the acceptable output range.</p>
O2 SENSOR DISC	The oxygen sensor cord has become disconnected (or is damaged enough to cause an open circuit).
SERVICE O2 MON	Oxygen zero calibration values are invalid.

**Oxygen
Monitoring
Problem
Resolution**

Problem	Possible Cause	Remedy
Display area remains blank when a reading is expected. O2 CAL DUE message on alarm display.	Sensor needs calibration	Perform proper calibration. Remove sensor from breathing circuit. Make sure sensor is exposed to room air only.
Pressing [O2 Cal] control button does not initiate calibration	Sensor is disconnected	Reconnect oxygen sensor cord to input receptacle on Narkomed 6400.
	Sensor cord is damaged	Replace oxygen sensor housing/cord assembly.
Pressing [O2 Cal] control button initiates calibration, but display window remains blank at end of calibration period	Sensor is exposed to incorrect oxygen concentration	Expose sensor to room air for 21% calibration.
	Sensor exposed to constantly changing calibration mixture	
	Sensor capsule was removed from housing for a prolonged period	Allow a waiting period equal to duration of capsule removal.
	New capsule not given proper waiting period	Allow a 15 minute waiting period.
	Exhausted or defective sensor capsule	Replace oxygen sensor capsule. Allow a 15 minute waiting period.
O2 SENSOR DISC and O2 CAL DUE messages appear on central alarm display during monitoring.	Defective sensor housing and cable	Replace oxygen sensor housing/cable assembly.
	Sensor cord is disconnected	Reconnect oxygen sensor cord to input receptacle on Narkomed 6400.

Machine Input Alarms

System error messages may also appear during a case.

Cautions

Message	Condition
AC/BATTERY FAIL	AC failure and battery low

Advisories

Message	Condition
AC POWER FAIL	AC failure
BATTERY LOW	Battery charge is low
DC POWER FAIL	Ventilator DC power bad

System Communications Alarms

Warnings

Message	Condition
VENT COMM ERR	Ventilator communications failure
VPO COMM LOST	Communications lost with VPO monitor

Advisories

Message	Condition
GAP COMM LOST	Communications lost with gas analysis pod

Miscellaneous Alarms

Warnings

Message	Condition
VENT FAILURE	Ventilator failure

Cautions

Message	Condition
FRESH GAS LOW	Fresh gas low condition reported by ventilator

Advisories

Message	Condition
ALARMS SUSPEND	Alarms suspended
FRESH GAS HIGH	Fresh gas usage exceeded alarm threshold
GAP FAN FAILURE	Fan failure in gas analysis pod
PAPER OUT	SCR out of paper
SCR COMM LOST	Communications lost with strip chart recorder
SERVICE SPEAKER	Speaker failure detected (no current through primary speaker)
VENT FAN ERR	Ventilator Fan Failure
VENT STANDBY	Ventilator in Ventilator Standby status
VENT TEST DUE	No ventilator self-test for more than 10 days.
WPU TEMP HIGH	Temperature high in WPU

Ventilator Messages

Ventilator Test Messages

These messages may be displayed during ventilator self-test, leak and compliance test, or piston test. When an operator response is required, the following table provides a brief summary. However, for the full sequences of test procedures, see “Ventilator Self-Test” on page 7-5, “Ventilator Leak and Compliance Test” on page 7-19, or the “Divan Ventilator Self-Test Flow Chart” on page A-4-1.

Note: If the operator response fails to clear the message, contact an authorized representative of DrägerService.

Message	Description	Clinician Response
APL=30cmH₂O?	prompts clinician to set APL valve (pop-off valve) to 30 cmH ₂ O	Verify that APL valve is set to 30 cmH ₂ O (and, if applicable, toggle is set to MAN position). Confirm change by pressing selector/confirmation knob.
APL->MAN ?	displayed if APL valve is detected to be in Spont position or Man position with pressure set too low	Verify that APL valve is set to 30 cmH ₂ O (and, if applicable, toggle is set to MAN position). Confirm change by pressing selector/confirmation knob.
Breath sys lock?	displayed during self-test if pilot pressure < 50 cmH ₂ O	Verify that the compact breathing system assembly is properly locked into the ventilator; reseal and lock, if necessary. Resume operation by pressing knob.
Fresh gas off ?	prompts clinician to close all fresh gas control valves	Verify that all fresh gas flow control knobs are closed. Confirm change by pressing selector/confirmation knob.
Insert piston	displayed during self-test following Remove piston message	Reinstall piston assembly, push the piston handle fully down, and rotate the ventilator locking lever clockwise to its stop position. Confirm change by pressing selector/confirmation knob.
Insp. Valve ?	displayed during self-test if leak > 175 ml/min, to prompt clinician to verify that inspiratory valve disk is good	Inspect inspiratory valve disk and seat for possible cause of leak. Resume operation by pressing selector/confirmation knob.

Message	Description	Clinician Response
Leak= mL/min Leakage<20mL/min Manual leak =	displayed in self-test, to indicate breathing system leak rate	Check for the source of a large leak in the patient circuit or breathing system. When the leak has been corrected, resume operation by pressing knob.
Leakage>10L/min	displayed to indicate a very large leak somewhere in the patient circuit or compact breathing system	Inspect patient circuit components and compact breathing system for incorrect connections or damage. When the leak has been corrected, resume operation by pressing knob.
Leak accepted ? / Rerun leak test ?	displayed during self-test under certain leak conditions to enable the clinician to choose whether to accept the current leak rate or to find and correct the source of the leak; message text alternates until a choice is made.	Depress knob while appropriate text message is displayed to select.
Leaktest, Manual	displayed while bag is tested	No operator response required.
Leaktest, V Mode	displayed when ventilator is performing a leak and compliance test	No operator response required.
Piston fail/ Piston seal leak	displayed if piston seal leak is detected	Remove piston assembly. Disassemble piston assembly (see "Disassemble the Piston Assembly" on page 10-9) and inspect the roller diaphragm for improper assembly or damage which may cause a leak. Take corrective action as required. Reassemble piston assembly and reinstall. Resume operation by pressing selector/confirmation knob.
piston test	displayed during piston test, which occurs periodically during mechanical ventilation	No operator response required.

Message	Description	Clinician Response
Remove piston	displayed during self-test if ventilator cannot move piston	Remove piston assembly. Inspect the assembly for improperly assembled roller diaphragm, and take corrective action as required. Confirm change by pressing knob.
Self-test	displayed when self-test is started	No operator response required.
Subsyst.1/2 leak	displayed during self-test under certain leak conditions	Inspect patient circuit components and oxygen sensor for insecure connections or damage. Verify that APL valve retaining ring is securely tightened. Resume operation by pressing knob.
Subsystem 1 leak	displayed under certain leak conditions	Check for a leak in the patient circuit or at the inspiratory or expiratory valves. Inspect patient circuit components and oxygen sensor for insecure connections or damage. Resume operation by pressing selector/confirmation knob.
Subsystem 2 leak	displayed during self-test under certain leak conditions	Verify that APL valve retaining ring is securely tightened. Resume operation by pressing selector/confirmation knob.
Subsyst. 2 leak?	displayed during self-test under certain conditions	Inspect compact breathing system and piston assembly for possible gross leaks, such as at absorber canister mount or secondary vacuum relief valve. Resume operation by pressing selector/confirmation knob.
Subsystem 3 leak	displayed under certain leak conditions	Inspect breathing bag, fresh gas hose, and vaporizers for insecure connections or damage. Resume operation by pressing selector/confirmation knob.

Message	Description	Clinician Response
Supply pressure?	displayed during self-test if pilot pressure is not present	Check that oxygen at adequate pressure is supplied to the Narkomed 6400.
Testpress. error	displayed during a leak and compliance test	Verify that the airway pressure hose is properly connected to the compact breathing system. Check for a large leak in the patient circuit.
Valve disk fail	displayed during self-test if a leak is detected between the compact breathing system and control module	Verify that the compact breathing system assembly is properly locked into the ventilator; reseal and lock, if necessary.
Ypiece occluded?	prompts clinician to occlude Y-piece	Verify that Y-piece is occluded. Confirm change by pressing selector/confirmation knob.
Y-piece open ?	prompts clinician to open Y-piece	Verify that Y-piece is open. Confirm change by pressing selector/confirmation knob.

Ventilator Status Messages

The following messages are provided to the Narkomed 6400 operator for information only. Ventilator status messages rarely require any response from the operator.

Message	Description
x Cancel Test	displayed when clinician presses a button to cancel self-test; digit in space indicates number of times the self-test has been bypassed since the last complete self-test
COMPLETE TEST	displayed when clinician presses a button to cancel self-test, but self-test has been canceled 10 times since the last complete self-test, or an equipment failure has occurred since last complete self-test; ventilator is in safe state
compliance test	displayed during leak and compliance test
last cancel	displayed when clinician presses a button to cancel self-test for the 10th time since the last complete self-test
Manual/Spont.	displayed when ventilator is in Manual/Spontaneous Mode

Message	Description
PEEP= cmH2O	displayed continuously when ventilator is operating in Volume or Pressure Mode; digits in the spaces indicate the current set PEEP value
Power off	displayed momentarily when Narkomed 6400 is switched to standby
Resetting/ Resetting piston	displayed during an internal reset
SIMV Rate = /min	displayed continuously when the ventilator is operating in SIMV Mode; digits in the spaces indicate the SIMV Rate
Standby	displayed when ventilator is in Ventilator Standby
US.Version #	displayed momentarily when Narkomed 6400 is switched ON

Ventilator Operator Prompts

All messages for changes of ventilation modes and parameter values are displayed in the alphanumeric display located on the operator control panel. The alphanumeric display also displays a message if the user attempts to change a ventilation parameter to a value which is limited indirectly by another parameter, such as maximum minute volume or maximum inspiratory flow rate. Confirm any change by pressing the selector/confirmation knob.

Message	Description
breath/min	displayed when clinician presses parameter setting button to change Rate; current value is shown on left, updated value on right
Flow/L/min	displayed when clinician presses parameter setting button to change inspiratory flow when ventilator is in Pressure Mode; current value is shown on left, updated value on right
__I:E__	displayed as appropriate when clinician presses parameter setting button to change I:E; digits are shown in spaces for current value on left, updated value on right
% Insp Pause	displayed when clinician presses parameter setting button to change % Inspiratory Pause; current value is shown on left, updated value on right
Manual/Spont. ?	displayed when clinician presses ventilation mode button to change to Manual/Spontaneous Mode
Max. Insp. flow	displayed when attempting to change a ventilation parameter, but limited by inspiratory flow rate

Message	Description
PEEP/cmH2O	displayed when clinician presses parameter setting button to change PEEP; current value is shown on left, updated value on right
Pediatric hoses?	displayed when Vt is changed from >200ml to < 200ml
Pmax/cmH2O	displayed when clinician presses parameter setting button to change Pmax; current value is shown on left, updated value on right
Pset/cmH2O	displayed when clinician presses parameter setting button to change Pset; current value is shown on left, updated value on right
Pressure Mode ?	displayed when clinician presses ventilation mode button to change to Pressure Mode
Reduce I:E Ratio	displayed when attempting to increase Rate, but limited by expiratory time
Reduce Rate	displayed when attempting to increase Vt but limited by minute volume, or when attempting to increase I:E ratio but limited by expiratory time
Reduce Volume	displayed when attempting to increase Rate, but limited by minute volume. This message may appear even in Pressure mode where the breath rate is limited so as not to exceed 25L minute volume, based on the last preset tidal volume.
SIMV Mode ?	displayed when clinician presses ventilation mode button to change to SIMV Mode
SIMV Rate	displayed when clinician presses ventilation mode button to change SIMV Rate; current value is shown on left, updated value on right
Standby ?	displayed when clinician presses control button to change to Standby
Volume Mode ?	displayed when clinician presses ventilation mode button to change to Volume Mode
Vt/mL	displayed when clinician presses parameter setting button to change Vt; current value is shown on left, updated value on right

Ventilator Error Messages

If corrective action fails to clear the condition, switch to Manual/ Spontaneous Mode of operation and contact an authorized representative of DrägerService. If ventilation is not possible in Manual/Spontaneous Mode selection, the ventilator override switch can be activated to bypass the ventilator.

Message	Description	Corrective Action
Breath Sys. fail	displayed during power-up self-test if a problem is detected in the compact breathing system	If the number 121 is displayed in the area to the left of the alphanumeric display, verify that the APL valve is adjusted to 30 cmH ₂ O (and, if applicable, toggle is set to MAN position). Reset APL valve as required and press confirm knob to rerun test, otherwise replace the compact breathing system and/or contact an authorized representative of DrägerService.
	displayed during normal operation if pressure measured in the breathing system is <-10 cmH ₂ O for more than 20 seconds	<ol style="list-style-type: none"> 1. Immediately remove the source of vacuum. 2. Attempt manual ventilation by pressing the manual/spontaneous button if applicable, press the confirm knob, and squeeze the breathing bag. 3. If manual ventilation is not possible, continue ventilation using a backup manual ventilation device. 4. After ensuring that the patient is adequately ventilated, lift the Divan tabletop and rotate the locking lever for the breathing system and piston assembly. 5. Grasp the handle of the breathing system and pull it to the left to ensure that the compact breathing system separates from the piston. You may hear a whooshing sound as the vacuum is relieved. 6. Re-latch the compact breathing system. 7. Fit the patient connection of the Y-piece to the plug on the bag mount arm and perform a leak and compliance test before reconnecting to the patient. <p>To prevent this situation from occurring, follow the guidelines given in "Use of Suction with the Narkomed 6400" on page 8-27.</p>

Message	Description	Corrective Action
Check Monitor	displayed when internal communication is not maintained with the system monitor	Complete the case and contact an authorized representative of DrägerService.
Contr.press. low	displayed whenever control pressure is determined to be low. This may be due to a leak in the ventilator's internal control pressure system, separate from the patient circuit.	<p>If this message is displayed during self-test, leak and compliance test, or within approximately 10 seconds after the ventilator is switched from Ventilator Standby status, do not proceed with a case.</p> <p>If this message is displayed during a case, but ventilator performance is not affected, complete the case.</p> <p>If ventilator performance is affected when this message is displayed, and the compact breathing system was disturbed prior to the appearance of the message, the breathing system may not be fully seated. The breathing system can be temporarily reseated by applying force horizontally to the left side of the compact breathing system, in order to complete the current case.</p>
Equipment fault	displayed momentarily when an equipment fault is detected; replaced by a fault number	See Fault Nr. message below.

Message	Description	Corrective Action
Exp.press.high	displayed at end of expiration if airway pressure significantly exceeds PEEP	<p>Check for possible sources of occlusion or restriction to the expiratory limb of the patient circuit or the scavenger system.</p> <p>Open the breathing system to relieve pressure, if necessary.</p> <p>If operating in Manual/Spontaneous Mode, switch to Volume or Pressure Mode.</p> <p>If error persists, activate the ventilator override switch to complete the case and then contact an authorized representative of DrägerService.</p>
Fault Nr.	displayed when ventilator is in safe state; number following text indicates equipment fault number	Complete the case by manually ventilating the patient, and then contact an authorized representative of DrägerService. The ventilator buzzer can be silenced by depressing the selector/confirmation knob.
Fresh gas low	displayed during expiration when breathing bag is not inflated enough to maintain airway pressure	Increase fresh gas flow rate.
Invalid	displayed when the button pressed is an invalid input for the current state of the ventilator	Recheck input of appropriate ventilator setting.
Keyboard error	displayed when 1 or more Mode buttons are pressed for more than 10 seconds	<p>Remove pressure from all buttons.</p> <p>If error persists, activate the ventilator override switch to complete the case and then contact an authorized representative of DrägerService.</p>
Pressure limit	displayed when operating in Volume Mode or SIMV Mode but limited by Pmax	Increase Pmax or decrease tidal volume.

Message	Description	Corrective Action
Pressure release	displayed to indicate continuous airway pressure >30 cmH ₂ O	Switch APL valve to Spont position if a patient is attached; or switch the ventilator to Ventilator Standby status if no patient is attached.
P-Sensor fault	displayed when a pressure sensor fault is detected	Verify that the airway pressure hose is undamaged and properly connected to the compact breathing system. If the Narkomed 6400 is equipped with the optional breathing system pressure gauge, verify secure connections at the T-fitting and the breathing system interface panel.
Raise Insp. flow	displayed when operating in Pressure Mode, but Pset is not achieved, due to inspiratory flow too low	Increase inspiratory flow rate.
Service Nr.	displayed when a minor fault is detected within the ventilator; ventilator is conditionally functional; number following text indicates service number	Record the Service Number and then resume operation by pressing selector/confirmation knob. Complete the case and then contact an authorized representative of DrägerService.

Ventilator Problem Resolution

Problem	Possible Cause	Remedy
Ventilator reports an abnormal message during test	Ventilator senses an abnormal condition	Perform operator response described in “Ventilator Messages” on page 19
Ventilator reports an error message during ventilation	Ventilator senses an abnormal condition	Perform corrective action described in “” on page 24
Depressing selector/confirmation knob does not confirm prompt	Selector/confirmation knob failure	Activate ventilator override switch
Excessive PEEP	Insufficient suction scavenger flow setting Inverse I:E ratio	Increase suction scavenger flow rate Reset ratio

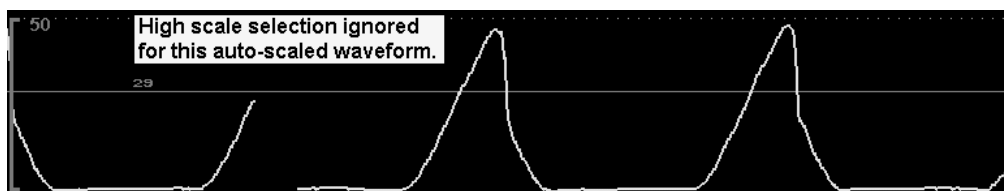
Problem	Possible Cause	Remedy
No control panel display	ventilator override activated	Determine reason for ventilator override being activated before resetting
Breathing rate is limited in Pressure Mode	Breathing rate is limited by potential maximum minute volume with previously set Vt	Decrease preset Vt

Hint Messages

There are several controls on the user interface that appear to be valid but because of certain conditions they are not active. Typically, controls that are not valid are disabled, however, there are exceptions where disabling them is not possible. An example is an alarm that has no associated alarm limit. When the user touches this alarm, there should be some positive feedback.

For each valid control listed in the table below, the associated hint message shall be provided in the specified location. A hint message shall be a small box with a yellow background containing text. All hint messages shall be displayed for 3.5 seconds if the hint message is a single line. If the hint message is greater than a single line, the message shall be displayed for five seconds.

Alarm hint messages may be removed sooner than 3.5 seconds if the user selects another alarm. Hint messages that are not associated with alarms should be removed sooner than 3.5 or five seconds if another hint message is displayed. Hint messages can be removed immediately by touching the hint message.



Invalid Control	Hint Message	Hint Location
Any alarm that has no associated alarm limit.	Selected Alarm has no limits.	To the right or left of the selected alarm text.
Pressure Alarm Bell while in the DIVAN Volume Mode.	Pressure alarm remains On during automatic ventilation.	To the left of the bell icon for breathing pressure.
Pressure Alarm Bell while in the DIVAN SIMV Mode.	Pressure alarm remains On during automatic ventilation.	To the left of the bell icon for breathing pressure.
Pressure Alarm Bell while in the DIVAN Pressure Mode.	Pressure alarm remains On during automatic ventilation.	To the left of the bell icon for breathing pressure.
Pressure Alarm Bell while in the DIVAN Comm. Lost (VENT COMM ERR).	Pressure alarm remains On when there is a ventilator communications error.	To the left of the bell icon for breathing pressure.
Pressure Alarm Bell while DIVAN in Standby.	Alarm remains Off when DIVAN is in Standby Mode.	To the left of the bell icon for breathing pressure.
Volume Alarm Bell while DIVAN in Standby.	Alarm remains Off when DIVAN is in Standby Mode	To the left of the bell icon for volume.
Agent Alarm Bell while DIVAN in Standby.	Alarm remains Off when DIVAN is in Standby Mode	To the left of the bell icon for Agent.
CO2 Alarm Bell while CAL in Progress.	Alarm remains Off when the Gas Bench is calibrating.	To the left of the bell icon for CO2.
Agent Alarm Bell while CAL in Progress	Alarm remains Off when the Gas Bench is calibrating.	To the left of the bell icon for Agent.
CO2 Alarm Bell during line block.	Alarm remains Off when there is a line block.	To the left of the bell icon for CO2.
Agent Alarm Bell during line block.	Alarm remains Off when there is a line block.	To the left of the bell icon for Agent.
LINE BLOCK alarm in alarm window.	Selected alarm has no limits.	To the right or left of the selected alarm text.
CO2 Alarm Bell during CO2/AGT Error.	Alarm remains Off when there is a CO2/Agent Error.	To the left of the bell icon for CO2.
Agent Alarm Bell during CO2/AGT Error.	Alarm remains Off when there is a CO2/Agent Error.	To the left of the bell icon for Agent.
CO2 Alarm Bell during CO2 Warmup.	Alarm remains Off during CO2 Warmup.	To the left of the bell icon for CO2.
Agent Alarm Bell during CO2 Warmup.	Alarm remains Off during CO2 Warmup.	To the left of the bell icon for Agent.
CO2 Alarm Bell during GAP COMM LOST.	Alarm remains Off when there is a GAP communications error.	To the left of the bell icon for CO2.

Invalid Control	Hint Message	Hint Location
Agent Alarm Bell during GAP COMM LOST.	Alarm remains Off when there is a GAP communications error.	To the left of the bell icon for Agent.
Pressure Alarm Bell during VPO COMM LOST.	Alarm remains Off when there is a VPO communications error.	To the left of the bell icon for Pressure.
Pressure Alarm Bell during automatic ventilation.	Pressure alarm remains On during automatic ventilation.	To the left of the bell icon for Pressure.
PRESSURE LIMIT alarm in breathing pressure parameter box.	Set Tidal Volume not delivered. Consider increasing Ventilator Pmax setting.	To the right or left of the alarm text.
P-SET NOT MET alarm in alarm window.	Insp. Pressure not achieved.	To the right or left of the alarm text.
Volume Alarm Bell during VPO COMM LOST.	Alarm remains Off when there is a VPO communications error.	To the left of the bell icon for Volume.
O2 Alarm Bell when O2 sensor is disconnected.	O2 sensor is not present.	To the left of the bell icon for Oxygen.
O2 Alarm Bell when O2 Cal is due on power up (alarm state is forced off).	Alarm remains Off when an O2 calibration is required.	To the left of the bell icon for Oxygen.
O2 Alarm Bell during VPO COMM LOST.	Alarm remains Off when there is a VPO communications error.	To the left of the bell icon for Oxygen.
O2 Alarm Bell during calibration.	O2 alarms disabled during calibration.	To the left of the bell icon for Oxygen.
O2 Alarm Bell during all other conditions.	O2 alarms are always on.	To the left of the bell icon for Oxygen.
Volume Alarm Bell during VOL SENS ERR.	Alarm remains Off when the volume sensor detects an error.	To the left of the bell icon for Volume.
Volume Alarm Bell during VOL SENSOR DISC.	Alarm remains Off when the volume sensor is disconnected.	To the left of the bell icon for Volume.
VOL SENS ERR alarm in alarm window.	Selected alarm has no limits.	To the right or left of the alarm text
Pressure Waveform High Scale	High scale selection ignored for this auto-scaled waveform.	To the right of the high-scale value in the waveform area.
Exp. Flow Waveform High Scale	High scale selection ignored for this auto-scaled waveform.	To the right of the high-scale value in the waveform area.
CO2 Waveform High Scale	High scale selection ignored for this fixed-scale waveform.	To the right of the high-scale value in the waveform area.
Hours, minute, or second selection on Timers page of the Utility Notebook when the timer remaining timer is active.	Stop the Time Remaining timer to select new time.	On the "Hours Minutes Seconds" row of the selection table.

Invalid Control	Hint Message	Hint Location
Monitor Standby softkey when DIVAN is in Volume, Pressure, SIMV, or Man/Spont Mode and there is no Ventilator communication error.	DIVAN ventilator must be in Standby Mode to enter Monitor Standby.	Above the Monitor Standby softkey.
FRESH GAS HIGH alarm in alarm window	Fresh gas usage threshold exceeded.	To the right or left of the alarm text
MAC HIGH alarm in alarm window	Total MAC > 3.0	To the right or left of the alarm text
2ND AGENT alarm in alarm window	A second agent has been detected.	To the right or left of the alarm text
AGENT MIX alarm in alarm window	More than two agents have been detected.	To the right or left of the alarm text
TIDAL VOLUME LOW alarm in alarm window (without PRESSURE LIMIT or FRESH GAS LOW alarm)	The Preset tidal volume is not being delivered.	To the right or left of the alarm text
TIDAL VOLUME LOW alarm in alarm window (with concurrent PRESSURE LIMIT alarm)	The Preset tidal volume is not being delivered. Consider adjusting Pmax on the ventilator.	To the right or left of the alarm text
TIDAL VOLUME LOW alarm in alarm window (with concurrent FRESH GAS LOW alarm)	The Preset tidal volume is not being delivered. Consider checking for adequate fresh gas flow rate and possible leak in airway or fresh gas delivery system.	To the right or left of the alarm text
TIDAL VOLUME LOW alarm in alarm window (with concurrent PRESSURE LIMIT and FRESH GAS LOW alarms)	The Preset tidal volume is not being delivered. Consider checking for adequate fresh gas flow rate and possible leak in airway or fresh gas delivery system.	To the right or left of the alarm text

Negative Pressure Dialog Box

When the Narkomed 6400 determines that negative pressure has been applied, a dialog box is displayed on the screen. The dialog box contains two control buttons. Pressing the **[OK]** button removes the dialog box from the screen. Pressing the **[Troubleshoot Now]** button displays a series of dialog boxes that contain procedures for correcting the problem.

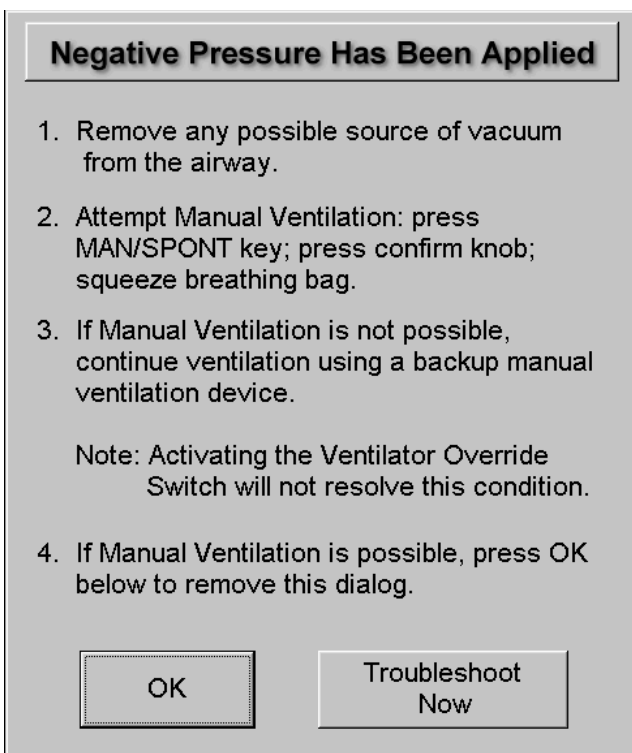


Figure 9-1. Negative Pressure Dialog Box

Note: To prevent this situation from occurring, follow the guidelines given in “Use of Suction with the Narkomed 6400” on page 8-27.

Breathing Hose Compliance Limit Dialog Box

When the Narkomed 6400 determines that the Divan ventilator can no longer compensate for the breathing hose compliance, a dialog box is displayed to alert the clinician. The dialog box also shows the numerical values for both the preset and the delivered tidal volumes. Pressing the **[OK]** button removes the dialog box from the screen.

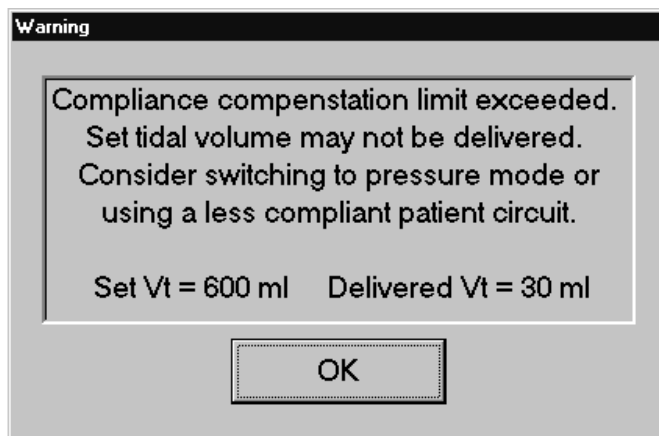


Figure 9-2. Breathing Hose Compliance Limit Detected Dialog Box

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10

General Care and Maintenance

This section provides instructions for clearing condensation, cleaning, and disinfecting, and basic maintenance of the Narkomed 6400 and its component systems.

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Powering Down the Narkomed 6400 for Cleaning

When moving the Narkomed 6400 for service or to clean up a fluid spill, the following procedure is recommended.

1. Turn the main switch to **STANDBY** position.
2. Unplug the AC power cord from the outlet.

Using this procedure will prevent the backup battery being drained.

Warning: When moving the anesthesia machine, remove all monitors and equipment from the top shelf, and use only the machine handles. The anesthesia machine should only be moved by people who are physically capable of handling its weight. Draeger Medical recommends that two people move the anesthesia machine to aid in its maneuverability. Exercise special care so that the machine does not tip when moving up or down inclines, around corners, and across thresholds (for example, in door frames and elevators) Do not attempt to pull the machine over any hoses, cords, or other obstacles on the floor.

General Care Instructions

Keep the system monitor; gas analysis pod; volume, pressure, and oxygen (VPO) monitor; and ventilator free of dust and dirt. Wipe any spills immediately.

Use only a lint-free cloth or sponge with soap and water or a diluted noncaustic detergent, for example, 70% ethanol or isopropanol, for cleaning.

Dilute sodium hypochlorite (5.2% household bleach) in 1:500 dilution (100 ppm free chlorine) can also be used on exterior surfaces, with the exception of the Divan ventilator and touch screen. For instructions specific to the Divan ventilator, see “Ventilator Cleaning, Disinfection, and Sterilization” below.

The touch screen can be cleaned using paper towels and household glass cleaner or any nonstatic sprays recommended for cleaning CRTs. Always dampen the towel and then clean the touch screen.

Note: Draeger Medical makes no claims about the efficacy of using the listed agents for infection control. Consult the institution's infection control procedures or officer.

To avoid damaging the components:

- Do not use strong cleaning agents or solvents, including acetone, ketone, alcohol-based cleaning agents, or Betadine.
- If noncaustic detergent or cleaning agents are used, be sure to dilute them according to the manufacturer's instructions.
- Do not use abrasive material, powder, or solutions.
- Do not submerge any part of the system.
- Do not let any liquid enter any of the components during cleaning, except as noted.
- Do not pour liquid on any of the components during cleaning, except as noted.
- Immediately wipe off all detergents.

Inspecting the System

Check the components and accessories for damage or deterioration. Check all cords for damage. Make sure no prongs or pins in the plugs and connectors are missing or bent. Replace any damaged or deteriorated items.

Ventilator Cleaning, Disinfection, and Sterilization

Clean and sterilize the Divan ventilator according to the guidelines below. Follow the institution's policies regarding specific methods and agents for cleaning and sterilization, subject to the criteria listed below. Determination of the need and frequency of sterilization of any particular component is the responsibility of the institution. Sterilization procedures should be performed according to procedures established by the institution, following the specific instructions provided by the manufacturer of the sterilizing equipment or agent to be used. Such policies, procedures, and instructions should ultimately be consistent with established principles of clinical microbiology and infection control.

Use only products based on aldehydes, alcohols, and quaternary ammonium compounds to ensure material compatibility. The following are not suitable for use on the ventilator or its parts, including the operator control panel:

- phenols
- compounds liberating halogen
- strong organic acids
- compounds liberating oxygen (including bleach)
- ethylene oxide.

The recommended cleaning methods for individual parts are summarized in the following table.

Part	Method		
	Disinfection by wiping or immersion	Steam sterilization at 121° C (250° F)	Steam sterilization at 134° C (273° F)
Ventilator Exterior	Wipe only		
Rubber parts: Breathing bag Breathing bag hose Roller diaphragm	♦ ♦ ♦	♦ ♦ ♦	♦ ♦ ♦
Metal parts: Cylinder head Piston Breathing system valves Breathing system parts		♦ ♦ ♦ ♦	♦ ♦ ♦ ♦
Plastic parts: Piston housing Absorber canister and screen APL valve	♦ ♦ ♦	♦ ♦ ♦	♦

Wipe Cleaning

Use a disposable cloth moistened with disinfectant cleaner for wipe cleaning. Follow the manufacturer's instructions for preparation and effective time.

Immersion Cleaning

Immerse the part in the applicable disinfectant. Follow the manufacturer's instructions for preparation and effective time.

Steam Sterilization

Perform a moist heat process, wipe cleaning, or both procedures before steam sterilization. All parts must be dry before the steam sterilization process. Minimum exposure is 20 minutes at 121°C (250° F) and 10 minutes at 134°C (273° F). Processing plastic and rubber parts at temperatures over 121°C accelerates deterioration.

Caution: Place the top half of the breathing system upright in the sterilization chamber with the sensor and control port openings facing downward, away from the possibility of any moisture dripping into the ventilator. Place the bottom half of the breathing system housing flat with the breathing system valves facing up. See Figure 10-1. Contact an authorized representative of DrägerService if water should enter the ventilator to possibly damage the sensors.

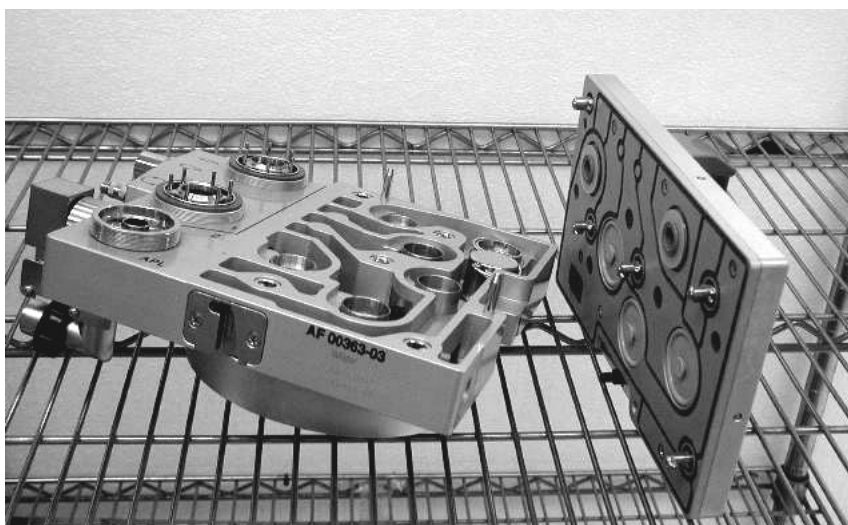


Figure 10-1. Placement of Ventilator Breathing System in Sterilization Chamber

Ventilator Routine Maintenance

Routine maintenance must be performed regularly to ensure safe and effective operation. Regularly check the condition of the absorbent and the overall condition of the machine, power cord, hoses, and breathing bag. It is suggested that patient circuit filters be used to minimize the risk of contamination to the ventilator and to subsequent patients.

Periodic Cleaning and Decontami- nation

The frequency level and need for cleaning and decontamination of the ventilator should be determined by the facility based on the condition of use and hospital infection control policy. In the event that patient circuit filters are not used, or there are cases involving infected patients, more frequent cleaning and decontamination may be required.

Ventilator Disassembly Instructions

Set the ventilator to **Ventilator Standby** before disassembling the ventilator.

Tools Needed: 6 mm hexagon key

Disconnect the Ventilator

1. Disconnect the pressure measuring hose and filter.
2. Disconnect the hose connected to the bag arm.
3. Disconnect the flow sensor.
4. Remove the 22 mm hoses from the inspiratory and expiratory valves.
5. Disconnect the fresh gas connector.

Disassemble the Ventilator

1. Unscrew the absorber canister clockwise (as viewed from top of ventilator) and carefully remove it from the system.

Warning: Absorbent is caustic and is a strong eye, skin, and respiratory tract irritant. When emptying the absorber canister, take care not to spill its contents.

2. Lift the table top.
3. Swing the breathing system locking lever to its central (unlock) position. See Figure 10-2.

Warning: The temperature of the breathing system heater may be as much as 65°C.

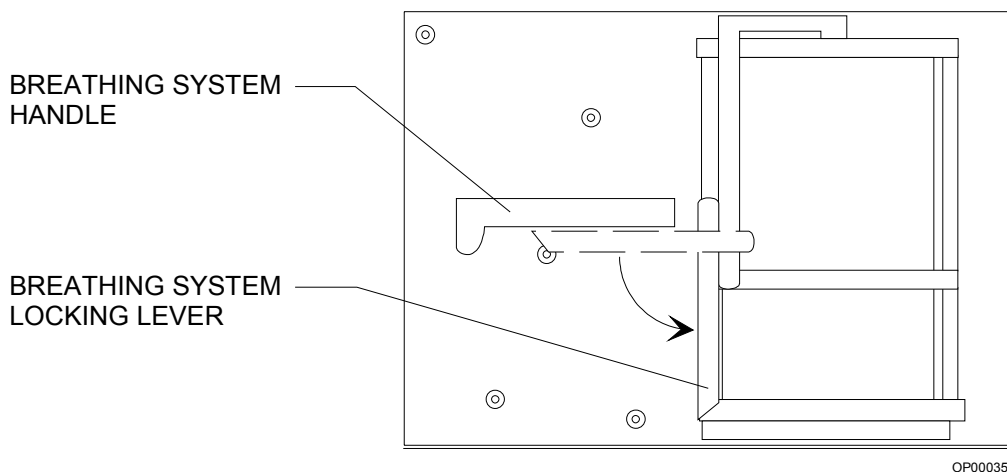


Figure 10-2. Location of Breathing System Locking Lever

4. Hold the breathing system by the handle and lift it out.

Take care not to damage the flat seals. Avoid contact with sharp edges. Place the breathing system so the sealing elements are not subject to constant pressure.

5. Raise the piston assembly handle to its up position and lift the assembly out. See Figure 10-3.

Note: If the piston assembly handle cannot be lifted to its full up position, DO NOT force the handle up as this will damage the piston coupling assembly. See “Removing the Piston Assembly” on page 10-15.

Do not damage the flat seals. Avoid contact with sharp edges. Place the piston so that the sealing elements are not subject to constant pressure.

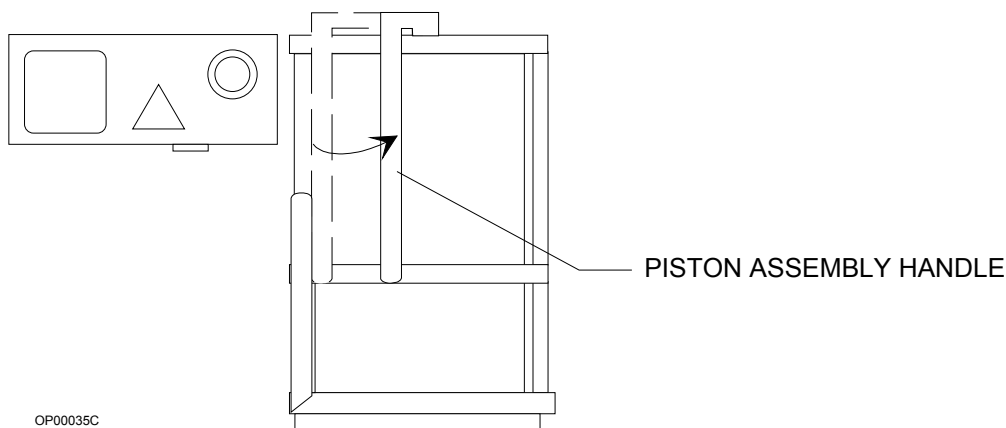


Figure 10-3. Location of Piston Assembly Handle

6. Swing the breathing system locking lever back to its locking position and close the table top.
7. Unscrew the APL valve and remove it from the ventilator.
8. Unscrew the inspiratory and expiratory valve caps and remove the sealing rings and valve disks.

Disassemble the Breathing System

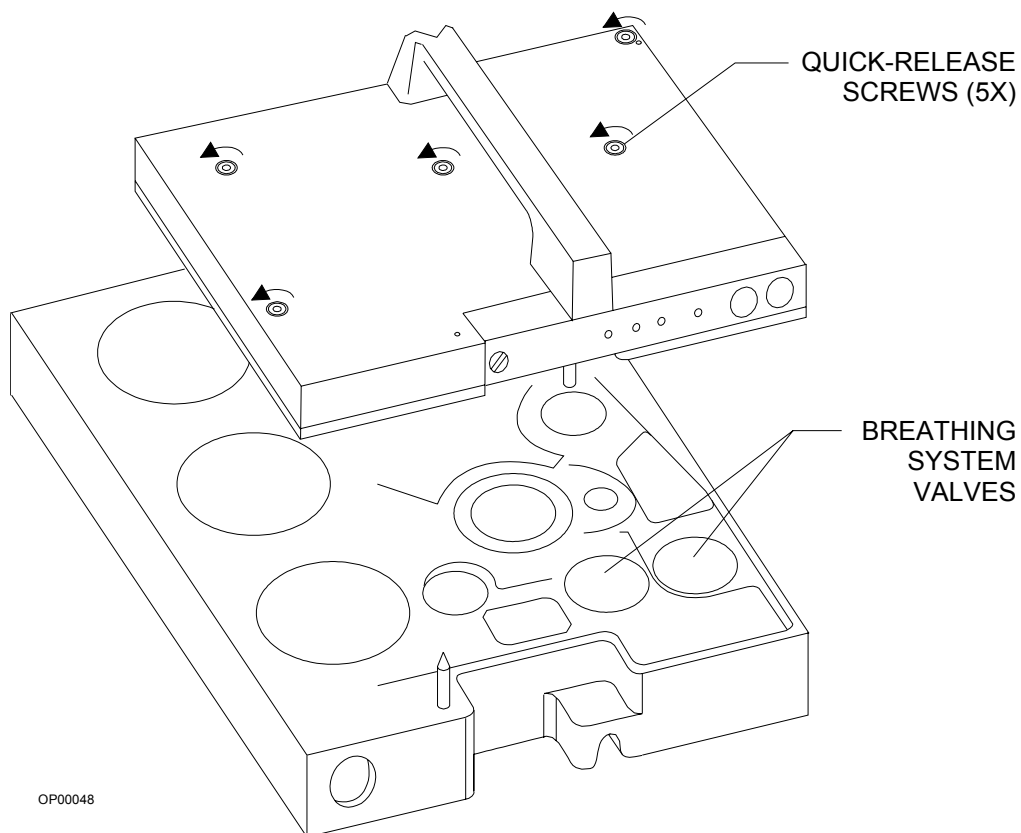
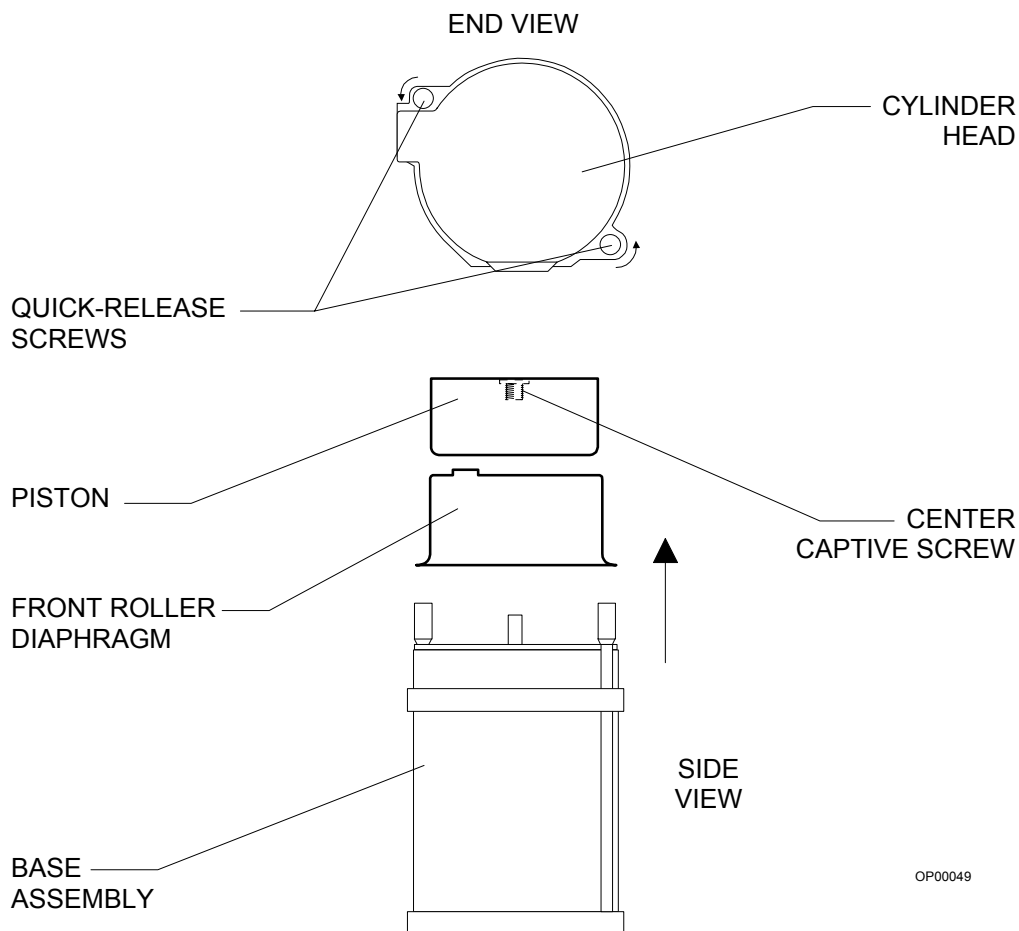


Figure 10-4. Breathing System Disassembly

1. Use 6 mm hexagon key to turn the five quick-release screws on the top of the breathing system a quarter-turn (counterclockwise).
2. Lift the top housing away from the bottom housing.
3. If the two valves inside are soiled, unscrew them to release them from the bottom housing.

Disassemble the Piston Assembly



OP00049

Figure 10-5. Piston Disassembly

1. Use 6 mm hexagon key to turn the two quick-release screws on the top of the cylinder head a quarter-turn (counterclockwise).
2. Remove the cylinder head.
3. Completely unscrew the central captive screw on the piston using 6 mm hexagon key.
4. Remove the piston and front roller diaphragm.

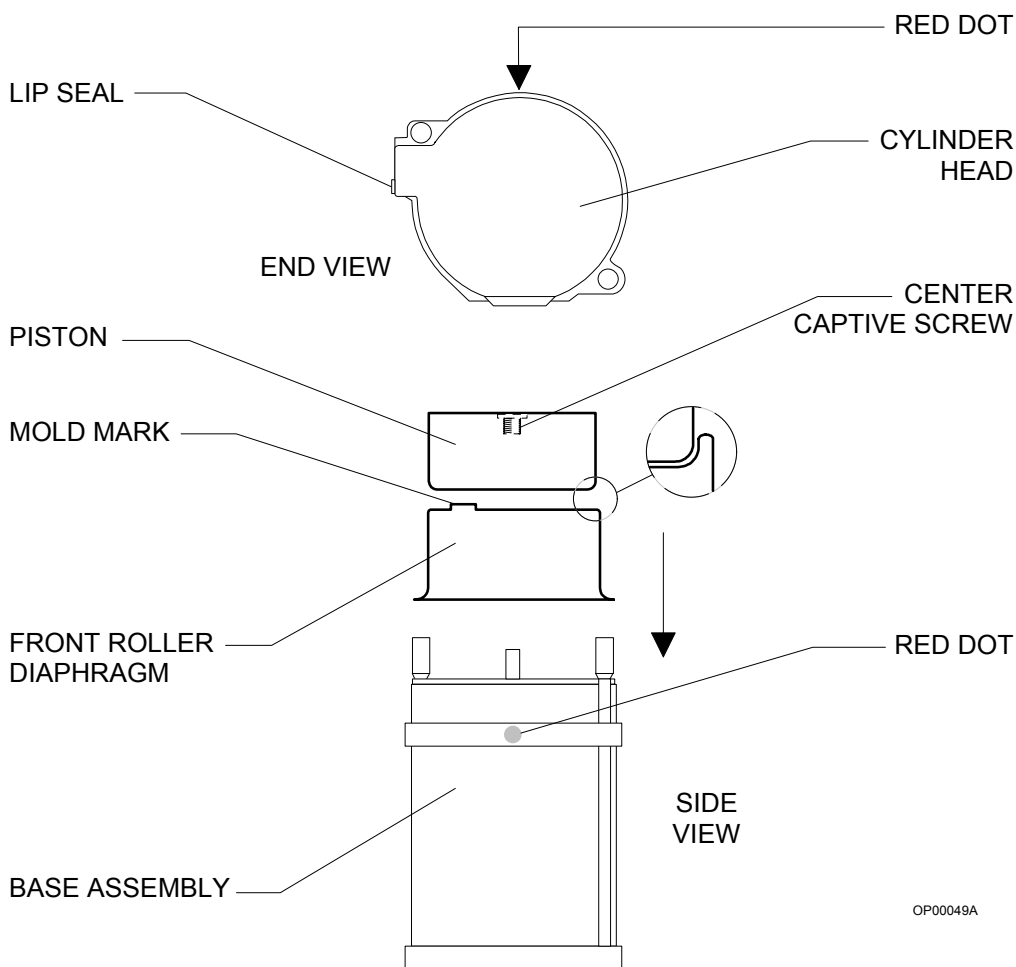
The remainder of the piston assembly does not contact breathing gas, therefore does not need to be sterilized.

Ventilator Reassembly Instructions

Make sure all parts are dry before reassembling the ventilator.

Tools needed: 6 mm hex key

Assemble the Piston Assembly



OP00049A

Figure 10-6. Piston Reassembly

1. Check the lip seal for pressure marks and cracks. Have it replaced if needed.
2. Check the diaphragm for cracks, holes, or any deformation. Replace it if needed.
3. Place the **TOP** mark on the diaphragm so it is visible at the outside.
4. Insert the piston by carefully placing the lipped edge of the diaphragm around the edge of the piston.
5. Tighten the piston into position with the center captive screw.

Note: Tighten firmly. This is not a quick-release screw.

6. Place the cylinder head on top of the assembly, matching the screw holes and aligning the red dots on cylinder head and base assembly.
7. Secure the cylinder by tightening the two quick-release screws with a 6 mm hex key.

Assemble the Breathing System

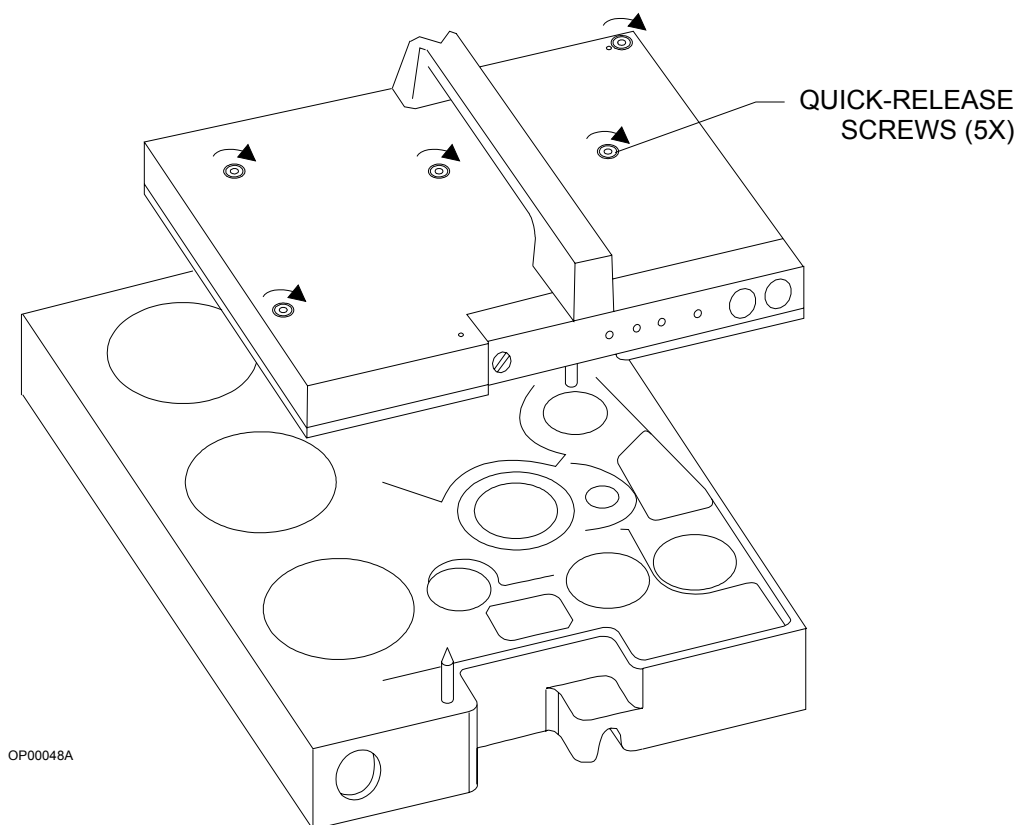


Figure 10-7. Breathing System Reassembly

1. Check the lip seals for pressure marks and cracks. Have them replaced, if needed.
2. Check the diaphragms for cracks, holes, or any deformation. Have them replaced, if needed.
3. Check the valve disks for damage such as chipping. Replace if needed.
4. Make sure the holes along the side of the top housing are clear.
5. Place the upper and lower housings of the breathing system together, matching the five screw holes.
6. Tighten the five quick-release screws with a 6 mm hex key.
7. Press the button on the secondary vacuum relief valve, and verify that it operates freely (see Figure 10-8).

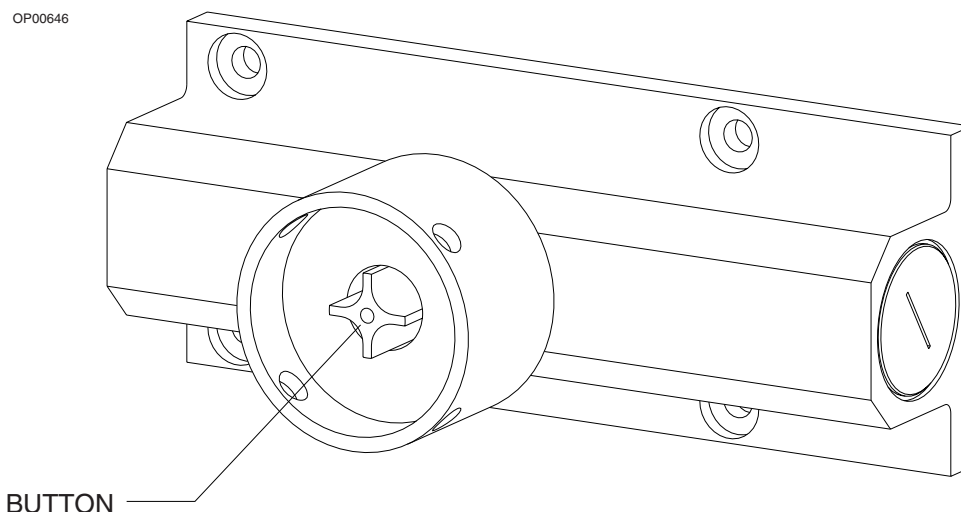


Figure 10-8. Gas Channel Block with Secondary Vacuum Relief Valve

Reseat the Piston Assembly

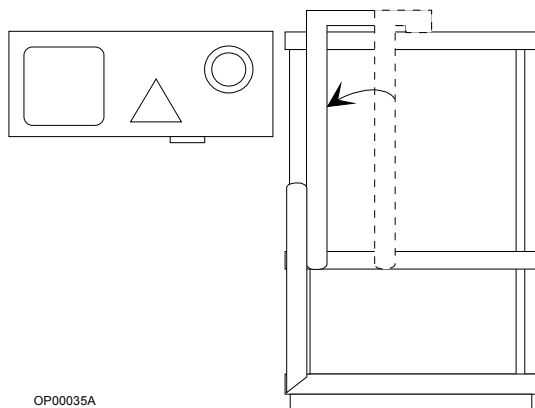


Figure 10-9. Reseating the Piston Assembly

1. Lift the ventilator table top.
2. Switch the breathing system locking lever to the unlock position.
3. Hold the piston assembly by its handle and place it in the machine.

Caution: Be careful not to damage the lip seals when replacing the piston.

4. Swing the piston assembly handle to the left and down as far as possible. See Figure 10-9.

Reseat the Breathing System

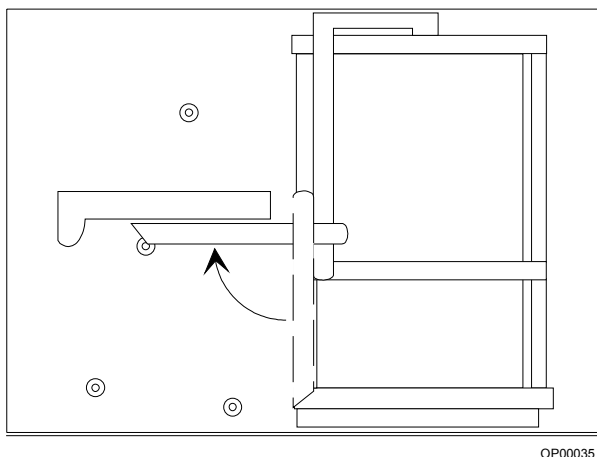


Figure 10-10. Reseating the Breathing System

1. Hold the assembled breathing system by its handle and insert it in the machine.

Caution: Be careful not to damage the lip seals when replacing the breathing system. Seat breathing system to the right.

2. Swing the breathing system locking lever into its lock position. See Figure 10-10.

Note: The piston assembly handle must always be in its down position before latching the breathing system locking lever.

Assemble the Inspiratory/Expiratory and APL Valves

1. Fit the valve disks in the inspiration and expiration valves.
2. Fit the sealing rings.
3. Screw on the valve caps.
4. Screw on the APL valve.

Note: With the knob-style APL valve, the index mark located at the bottom of the valve should face the front of the machine. With the toggle-style APL valve, the graduations should face the front of the machine.

Replacing the Absorbent

The absorbent changes color from the bottom to the top when it is saturated with CO₂. Refer to the manufacturer's instructions for the specific signs to expect when the absorbent is saturated.

If the Narkomed 6400 has been out of use or in storage, replace the absorbent before using the machine. Draeger Medical recommends establishing a routine schedule with a sufficient safety margin for replacing absorbent.

Warning: Change the absorbent if fresh gas has flowed continuously without the use of the Narkomed 6400 on patients (e.g., if machine has been left on over a weekend).

Additionally, it has been observed that excessively dry absorbent can react chemically with inhalation anesthetics (especially sevoflurane), resulting in the breakdown of the anesthetic.

When using loose absorbent, do not fill above the maximum fill level line located about a quarter-inch from the top of the canister. The clearance and the ratio of the canister diameter to screen opening minimize the potential for channeling. With channeling, gas flows through the canister along the path of least resistance. The gas depletes the efficiency of the absorbent along this route, bypassing absorbent in other areas of the absorber.

1. Place the chain on the bottom of the container.
2. Insert the screen.

Caution: The screen must be inserted in the container. This is absolutely essential for absorption.

3. Fill the canister with absorbent.

Uniformly fill the container with soda lime all around until the **-MAX-** mark is reached. Gently shake the container or knock it gently against the table to settle the contents. Remove any dust or spill from the edge of the container.

Warning: Absorbent is caustic and is a strong eye, skin, and respiratory tract irritant. Use care in handling the absorbent to avoid spills.

4. Fit the canister into position below the breathing system and turn it counterclockwise (as viewed from top of ventilator) as far as it will go. See Figure 10-11.

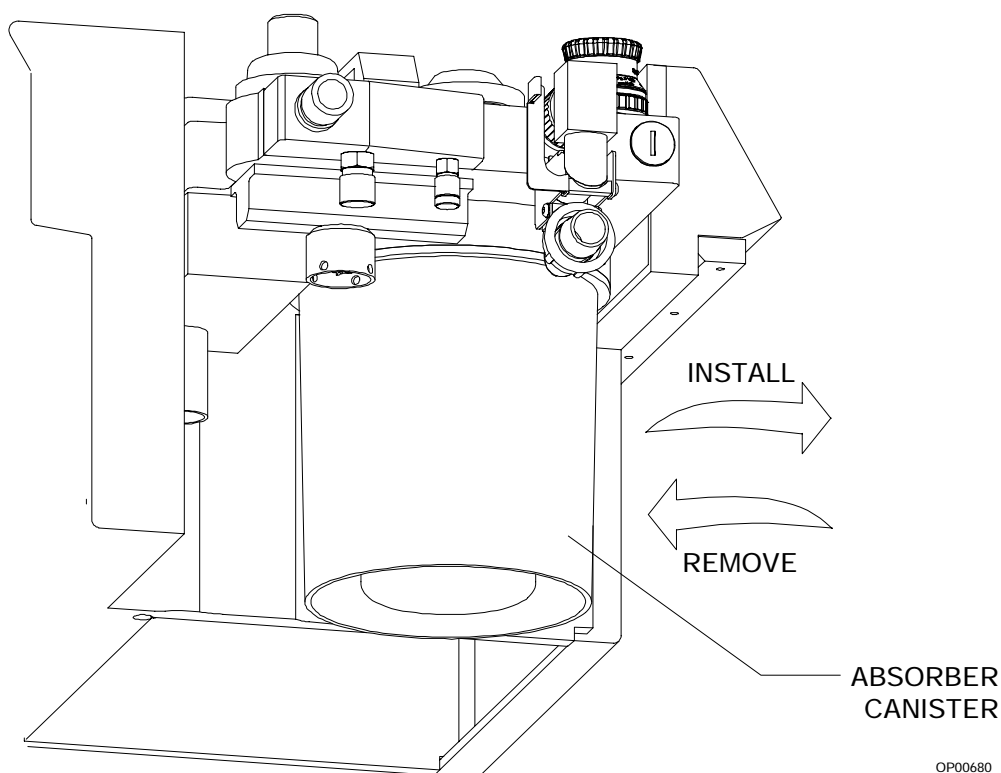


Figure 10-11. Replacing Absorber Canister

Reconnect the Ventilator

1. Connect the fresh gas hose to the breathing system from below with plug connector.
2. Connect pressure measuring line into coupling until it engages.
3. Connect the flow sensor.
4. Connect the 22 mm breathing hoses to the inspiratory and expiratory connections.
5. Connect the hose between the compact breathing system bag fitting and the bag arm.

Removing the Piston Assembly

If the piston assembly handle cannot be lifted to its full up position, it means that the piston assembly had not been installed correctly. The following procedure will correct the problem and allow the removal of the assembly.

Caution: If the piston assembly handle cannot be lifted to its full up position, DO NOT force the handle up as this will damage the piston coupling assembly.

Note: For correct operation, the “U” shaped channel on the piston coupling assembly should be in the up position when the piston assembly is removed from the ventilator chassis, and should be in the down position when the piston assembly is properly installed in the ventilator chassis. See Figure 10-12.

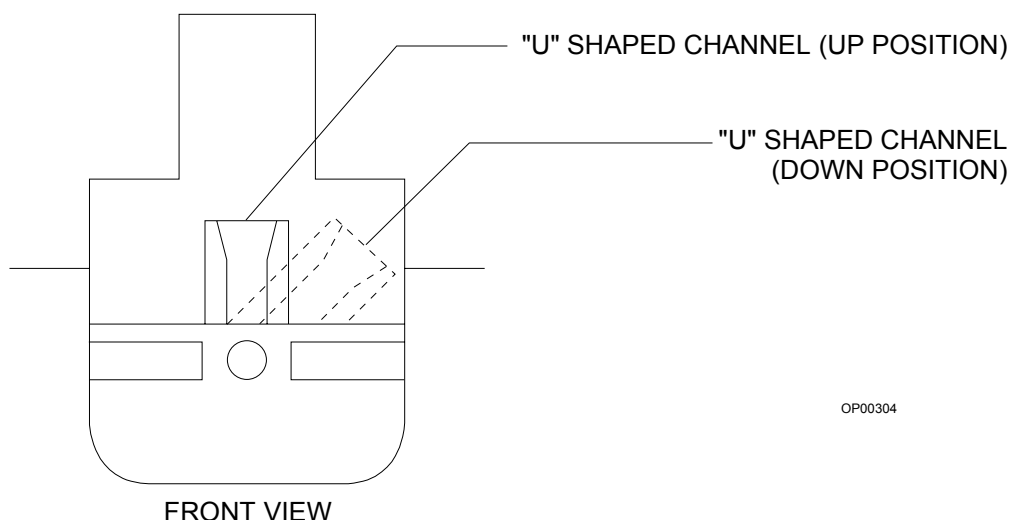


Figure 10-12. Piston Coupling Assembly - “U” Shaped Channel

If the “U” shaped channel is inadvertently left in the up position when the piston assembly is installed in an incorrect assembly sequence, the following procedure will restore correct operation.

1. Turn the System Power switch to STANDBY.
2. Turn the breathing system locking lever to its unlocked position, and ensure that the piston assembly handle is in its down position.
3. Look through the window in the metal plate behind the piston-cylinder unit and observe the “U” shaped channel. Refer to Figure 10-12. Using the red “T” handled Divan tool or a screwdriver, move the “U” shaped channel back approx. ½ in., and then push it to the right until it snaps out of view to its down position.

Note: The piston assembly handle must always be in its down position before latching the breathing system locking lever. Do not operate the ventilator with the piston assembly handle in the up position.

4. Turn the breathing system locking lever to its locked position.

5. Turn the System Power switch to ON, and allow the power-up sequence to complete. When the Divan displays “Standby” mode, it should be possible to remove and reinstall the piston assembly in the correct manner.

Replacing the Oxygen Sensor

Replace the oxygen sensor capsule when its sensor is depleted or when the sensor reaches its expiration date — whichever occurs first. The expiration month and year are printed on the side of the sensor capsule.

Depletion of the oxygen sensor can most often be detected by a display of **O2 CAL ERR** advisory, or by an inability of the system to calibrate the O₂ sensor.

Warning: A depleted sensor cannot correctly analyze oxygen concentration.

1. Unplug the O₂ sensor cable from the patient connection panel on the lower left front of the machine. The connector is a latching type, so pull back on the latching sleeve first, then pull out the connector.
2. Pull the oxygen sensor housing from the inspiratory valve dome. (It is a press-on fit.)
3. Unscrew the cover from the sensor housing and remove the sensor capsule.
4. Remove the replacement sensor capsule from its shipping container and install it in the housing. Ensure that the copper rings on the capsule mate with the electrical contacts in the sensor housing.
5. Wait 15 minutes to allow the sensor capsule to stabilize.
6. Plug the O₂ sensor cable back into the machine and perform a calibration. See “Calibrating the Oxygen Monitoring System” on page 5-18 for details.

Clearing Condensation from the Flow Sensor

Depending on the conditions of use and the environment, condensation can accumulate in the flow sensor housing. Moderate amounts of condensation should not affect operation. Excessive condensation can result in erratic or total loss of flow measurement.

To remove condensation:

1. Disconnect the 22 mm hose from the flow sensor assembly.
2. Loosen the retaining ring on the mounting adapter and remove the flow sensor assembly, taking care that the sensor cable does not snag.
3. Press down on the black lever under the flow housing and remove the flow housing and transducer assembly from the electronics housing.

4. Pull both transducers out of the flow housing.

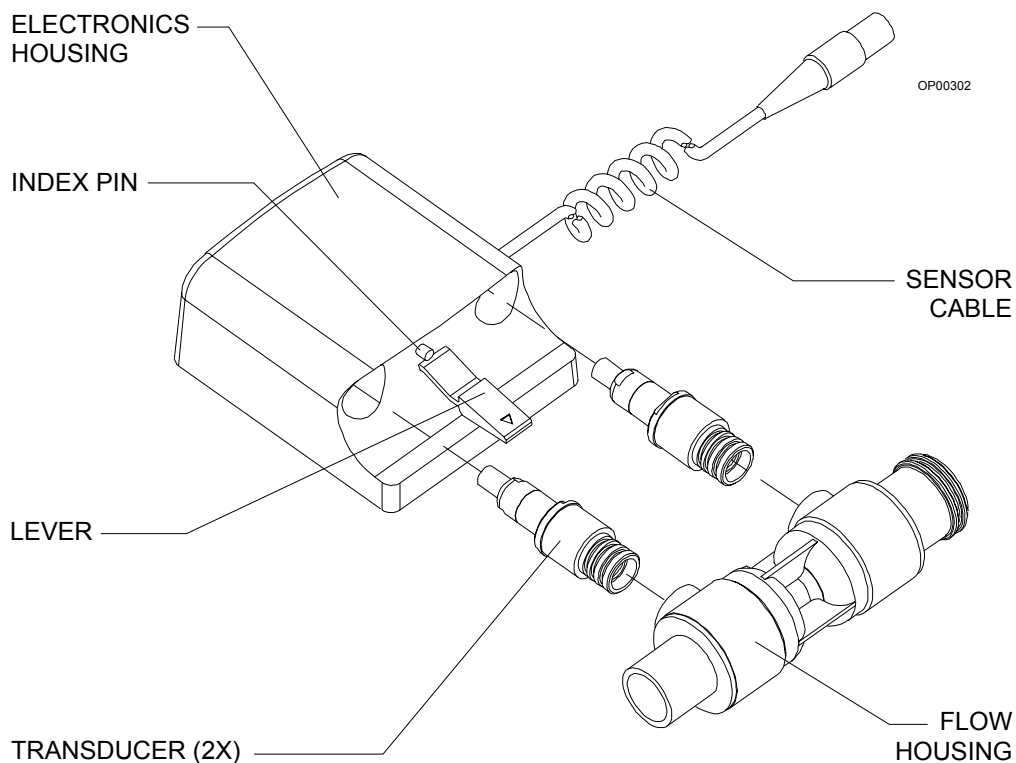


Figure 10-13. Disassembled Flow Sensor

5. Tip and shake the flow housing to release fluid trapped in the housing.
6. Make sure that all large droplets are cleared from the transducer ports.
7. Pat the transducers dry with a soft lint-free cloth.
8. Press the transducers back into their ports in the flow housing.
9. Slide the electronics housing over the transducers and flow housing assembly. Be sure that it clicks into place.

Note: If the flow housing assembly does not fit easily into the electronics housing, make sure the flow housing is facing the right direction. Refer to the illustration on the electronics housing to determine direction. The index pin on the electronics housing should align with the hole in the flow housing. If the flow housing is properly aligned, try gently shifting the flow housing left and right until the assembly fits easily into the electronics housing and the lever clicks into place.

10. Align the tab on the mounting adapter with the corresponding slot in the side of the flow sensor, and connect the flow sensor assembly to the mounting adapter. Tighten the retaining ring (hand-tighten only). Refer to Figure 10-14 on page 10-21.
11. Reconnect the 22 mm hose to the flow sensor assembly.

Disinfecting the Flow Sensor

The frequency, level, and need for cleaning or disinfection of the flow sensor should be determined by the facility, based on the conditions of use and hospital infection control policy.

If disinfection is required, first clean, dry, and then disinfect the flow sensor according to guidelines provided in this chapter. These procedures should be performed according to procedures established by the institution, following the specific instructions provided by the manufacturer or the equipment or agents used.

Caution: To avoid damaging the flow sensor:

- Do not use Betadine®, Povodine®, Sagrotan®, Mucocit®, acetone, ketone, xylene, or anesthetic agents for cleaning.
- Strictly follow the manufacturer's instructions when diluting cleaning agents before use.
- Do not use abrasives such as steel wool, liquid abrasives, or powder abrasives.
- Do not let any liquid enter the interior of the electronics housing.
- Do not submerge the electronics housing.
- Do not pour or spray liquid directly on the electronics housing. Always moisten a clean, soft, lint-free cloth with the appropriate cleanser before applying it to the electronics housing.
- Wipe any spills, cleanser, or any impurities off of the surface with a clean, soft, lint-free cloth.

Disassembly Instructions

1. Disconnect the sensor cable from the system interface panel.
2. Disconnect the 22 mm hose from the flow sensor assembly.
3. Loosen the retaining ring on the mounting adapter and remove the flow sensor assembly, taking care that the sensor cable does not snag.
4. Press down on the black lever under the flow housing and remove the flow housing and transducer assembly from the electronics housing.
5. Pull both transducers out of the flow housing.

Care and Cleaning

Flow Housing and Transducers Wash the flow housing and transducers with mild detergent and water. Follow with a distilled water rinse. These components can be immersed.

Electronics Housing and Sensor Cable Wipe the electronics housing and sensor cable with a clean, soft cloth moistened with mild detergent and water. Take care not to allow any fluid to access the interior of the electronics housing.

Disinfection

Flow Housing and Transducers The flow housing and transducers can be autoclaved at a temperature not to exceed 121° C. Follow the manufacturer's instructions for the process. Allow the transducers to normalize for 30 minutes under room ambient conditions before using them.

Electronics Housing and Sensor Cable The electronics housing and sensor cable can be wiped with a clean, soft, lint-free cloth moistened with a 70% to 90% diluted solution of ethyl or isopropyl alcohol or sodium hypochlorite (5.2% household bleach) at 1:500 dilution (100 ppm chlorine).

Note: Draeger Medical makes no claims about the efficacy of these agents or this method of cleaning for infection control. Consult the hospital's infection control officer or epidemiologist.

Reassembly Instructions

1. Press the transducers into their ports on the flow housing. Ensure that the three O-rings on each transducer are not damaged and are properly seated.
2. Slide the electronics housing over the transducers and flow housing assembly. Be sure that it clicks into place.

Note: If the flow housing assembly does not fit easily into the electronics housing, make sure the flow housing is facing the right direction. Refer to the illustration on the electronics housing to determine direction. The index pin on the electronics housing should align with the hole in the flow housing. If the flow housing is properly aligned, try gently shifting the flow housing left and right until the assembly fits easily into the electronics housing and the lever clicks into place.

3. Align the tab on the mounting adapter with the corresponding slot in the side of the flow sensor, and connect the flow sensor assembly to the mounting adapter. Tighten the retaining ring (hand-tighten only). See Figure 10-14.
4. Connect the 22 mm corrugated hose to the flow sensor assembly.

5. Connect the flow sensor cable to the volume sensor receptacle on the system interface.
6. Make sure the Narkomed anesthesia system is powered on.
7. Check the monitor to see if a **VOL SENSOR DISC** advisory is displayed. If not, proceed to the next step. If the advisory is displayed, refer to “Volume Monitoring Problem Resolution” on page 9-9 of this manual for instructions.

Perform the preuse checkout procedure provided in this manual, Section 7.

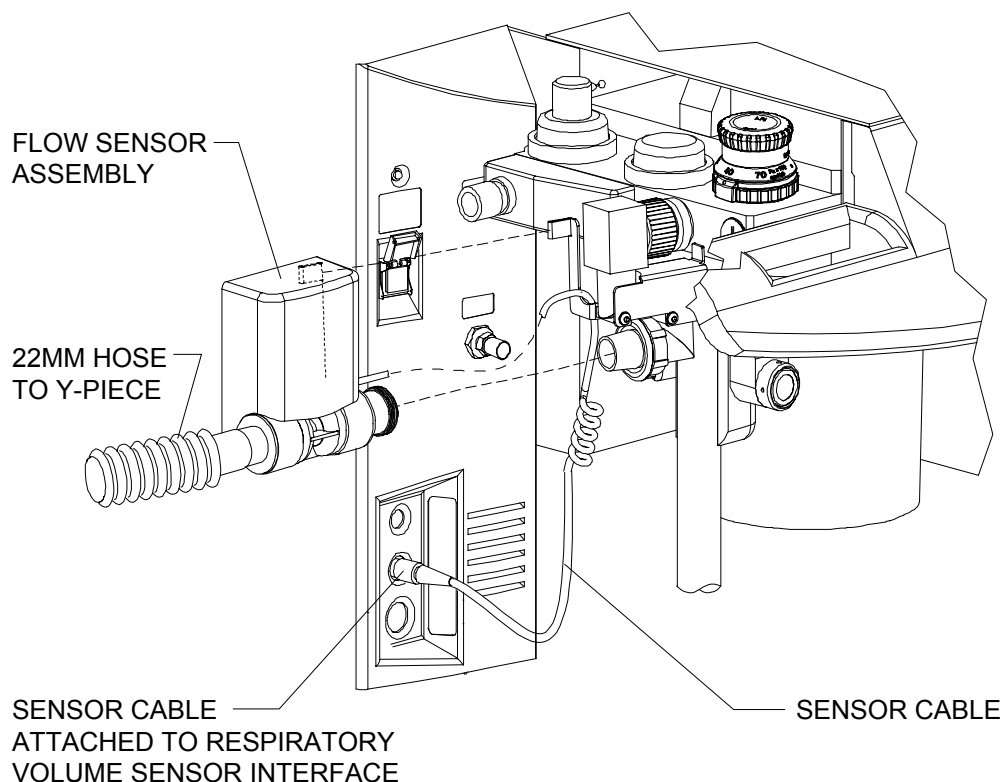


Figure 10-14. Installing the Flow Sensor

Cleaning and Disinfecting the Breathing System Pressure Gauge

Wipe the pressure gauge assembly with a soft lint-free cloth moistened with mild detergent and water. Dry the assembly before reinstalling.

The gauge can be disinfected with ethylene oxide gas, followed by appropriate aeration. Follow the manufacturer's instructions.

Caution: The breathing system pressure gauge cannot withstand immersion or the heat and pressure of autoclaving.

Open Reservoir Scavenger Maintenance

Clean the scavenger at least once every six months.

1. Clean the outer surface of the scavenger with a soft cloth moistened with mild detergent and water.
2. Remove and inspect all scavenger hoses for signs of deterioration. Replace any worn hoses.
3. Unscrew the wing nut until the needle valve assembly can be removed from its seat. Remove the nut and disassemble the valve. Inspect the needle valve and seat for lint or dust accumulation. Clean with compressed air, if necessary.
4. The flowmeter has a small port, located on its underside, that is open to the atmosphere. For the flowmeter to work properly, this port must remain open. Remove the flowmeter from the block and inspect this port. If it is blocked, clean it with compressed air.
5. Remove the reservoir canister from the scavenger body by unscrewing the four socket head cap screws located at the top of the canister.
6. Replace the cleaned needle valve assembly and reservoir canister. Verify that all parts are completely dry before reassembly.
7. Perform the open reservoir scavenger portion of the daily checkout procedure. See "Open Reservoir Scavenger System" on page 7-10 of this manual.

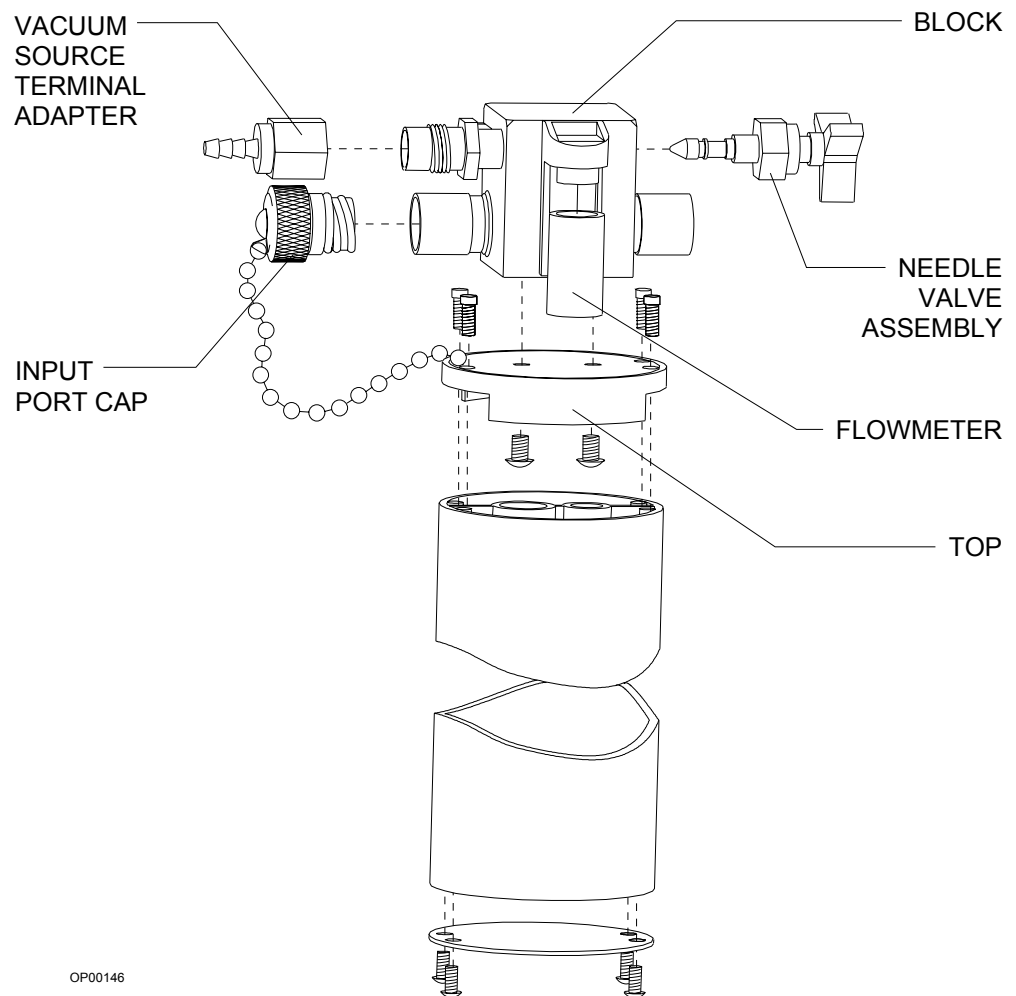


Figure 10-15. Open Reservoir Scavenger Maintenance

Maintenance for Passive Systems Scavenger Interface

Clean the scavenger at least once every six months. The positive pressure relief valve must be inspected and cleaned (if necessary) at six month intervals.

1. Clean the scavenger body with a moist cloth.
2. Inspect all scavenger hoses for deterioration. Replace any worn hoses.

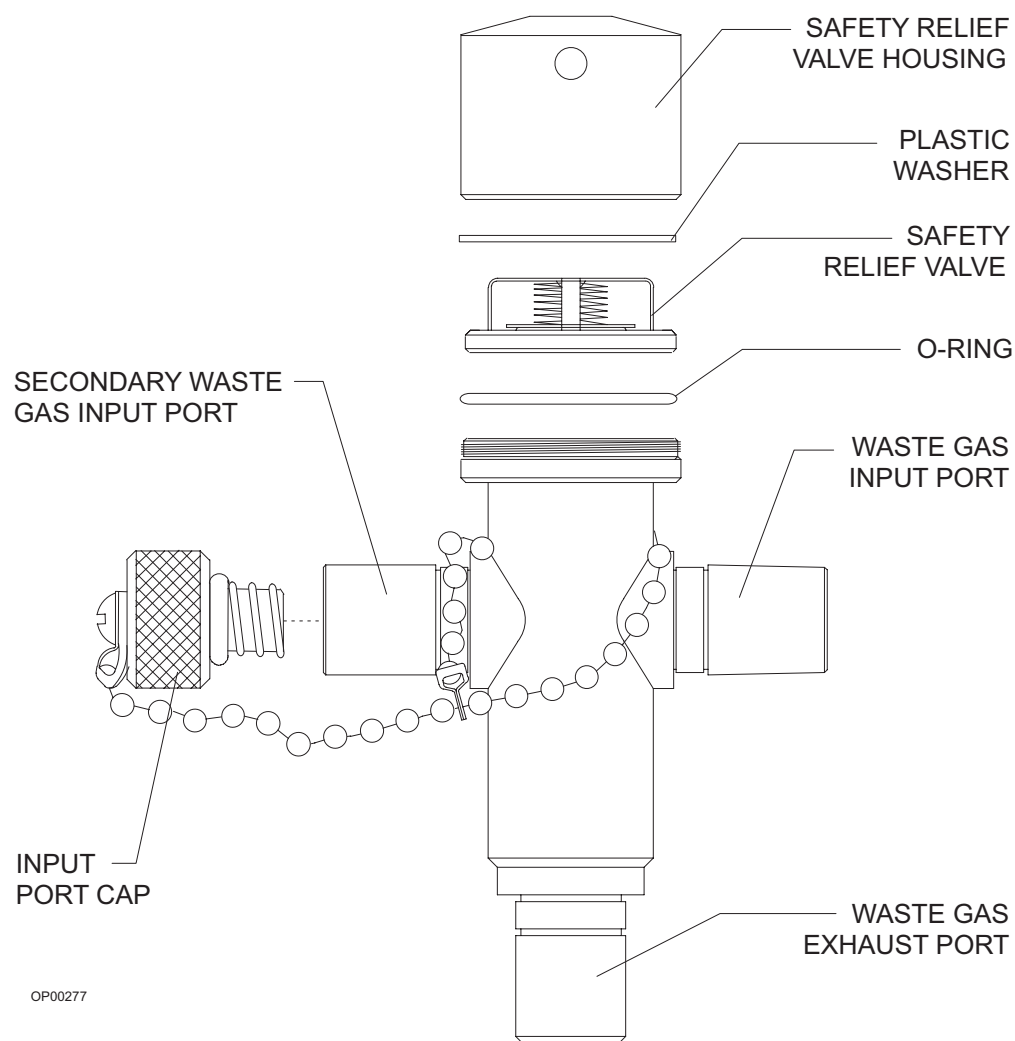


Figure 10-16. Passive Systems Scavenger Interface Maintenance

3. Remove the relief valve housing by unscrewing it counterclockwise.
4. Inspect the rubber O-ring. If it is worn, replace it.
5. Remove the relief valve by twisting it counterclockwise out of the housing. Use the tips of a needle-nose pliers to turn the valve, taking care not to damage the fragile valve disk.

6. Brush any accumulated lint or dust off the valve with a soft brush. The valve can be further cleaned with a low flow of clean air or oxygen.
7. Reinstall the valve into the housing, making sure that it is threaded all the way into the housing and that the plastic washer is properly seated on its upper surface.
8. Verify that the interior of the valve body is completely dry. Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.
9. Perform the scavenger interface for passive systems portion of the daily checkout procedure. See "Scavenger Interface for Passive Systems" on page 7-11 of this manual.

Water Trap Reservoir Maintenance

The water trap reservoir collects moisture from the patient sample line. It is attached to the bottom of the inlet block of the gas analysis pod. The water trap reservoir must be drained when it becomes full and must be replaced completely every 30 days. It is an important component for accurate nitrous oxide, agent, and carbon dioxide monitoring by the gas analysis pod.

Draining the Water Trap

The water trap must be drained when it becomes full or when a **LINE BLOCK** alarm is posted (with the sample line is correctly installed and free of any blockage).

1. To avoid damage, grip the water trap only by its ribbed surface as shown in Figure 10-17, and pull it out of its holder.

RIBBED SURFACE

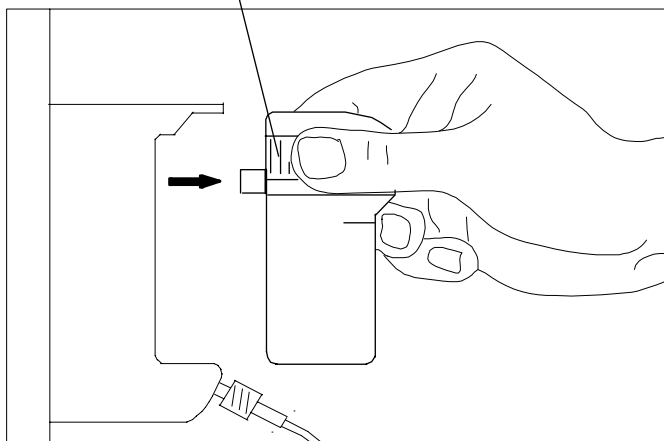
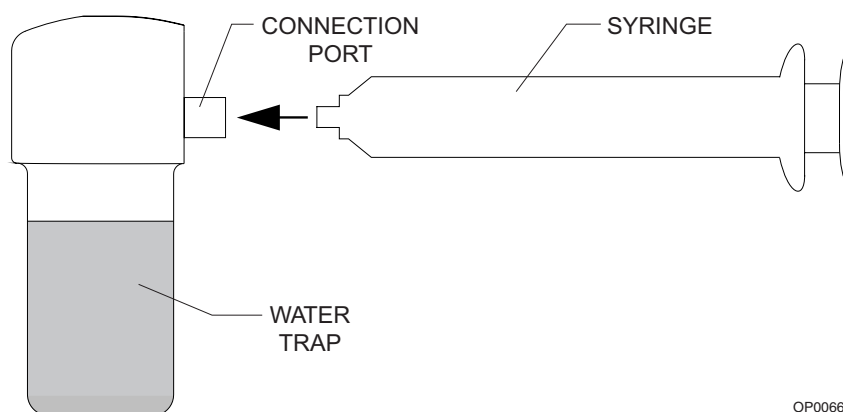


Figure 10-17. Removing the Water Trap

2. Insert an empty syringe (capacity 20 mL) without needle into the connection port as shown in Figure 10-18.
3. Draw off the water in the reservoir. Remove the syringe and dispose of it in an appropriate manner.
4. Push the water trap back into its holder until it clicks into place.



OP00661

Figure 10-18. Draining the Water Trap with a Syringe

Replacing the Water Trap

The water trap must be replaced under any of the following conditions:

- it becomes severely soiled
 - the **LINE BLOCK** alarm message persists even after the water trap has been drained (with the sample line correctly installed and free of any blockage)
 - the water trap has been in use for its maximum life of 30 days
1. To avoid damage, grip the water trap only by its ribbed surface as shown in Figure 10-17, and pull it out of its holder. Dispose of it in an appropriate manner.
 2. Push a new water trap into the holder until it clicks into place.

Replacing the Semi-Permeable Tube

The semi-permeable tube connects between the sample line and water trap. It is a 6-inch section of tubing constructed to draw water vapor through its walls while providing a leak-free conduit for the sampled breathing gas. Under conditions of severe humidity, it may be necessary to connect two 6-inch lengths of tubing in series. The semi-permeable tube is designed for limited multi-patient use and should be replaced when it ceases to function.

To replace the tube:

1. Remove the old semi-permeable tube by twisting the fittings on both ends counterclockwise. Dispose of properly.
2. Insert the male Luer-lock fitting on the sample line into the female Luer-lock fitting on the new semi-permeable tube, and twist clockwise to secure.
3. Insert the male Luer-lock fitting on the other end of the semi-permeable tube into the female Luer-lock fitting on the water trap, and twist until secure.

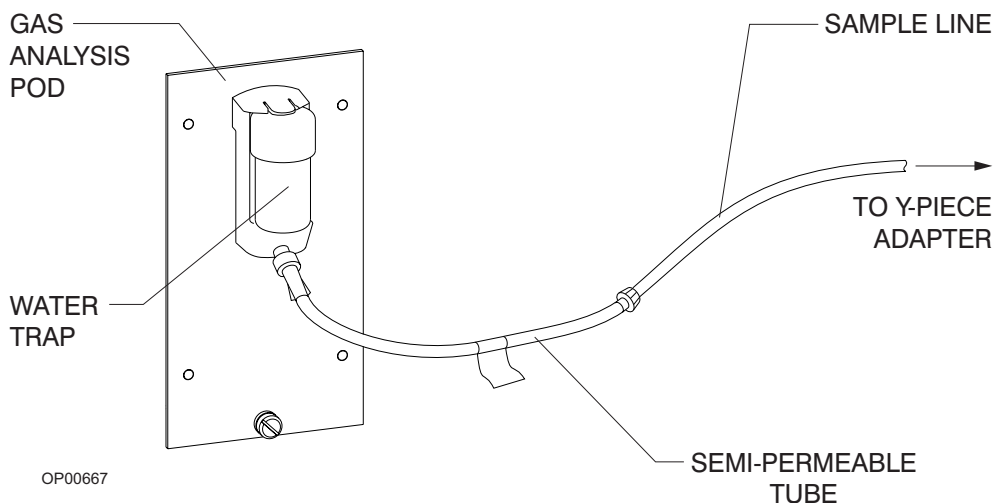


Figure 10-19. Semi-Permeable Tube Replacement

Care of Vaporizer

For care and cleaning of vaporizers, see specific instructions for the vaporizer being used.

Replacing the Strip Chart Recorder Paper

Follow the instructions below to load the roll paper into the strip chart recorder . Refer to Figure 10-20.

1. Open the paper compartment by pressing the latch located at the top right corner of the compartment.
2. Remove the old paper roll.
3. Insert the new paper roll with the paper feeding out the bottom. Pull the free edge of the paper out a little so that a short length of it protrudes when the paper compartment is closed.
4. Close the paper compartment.

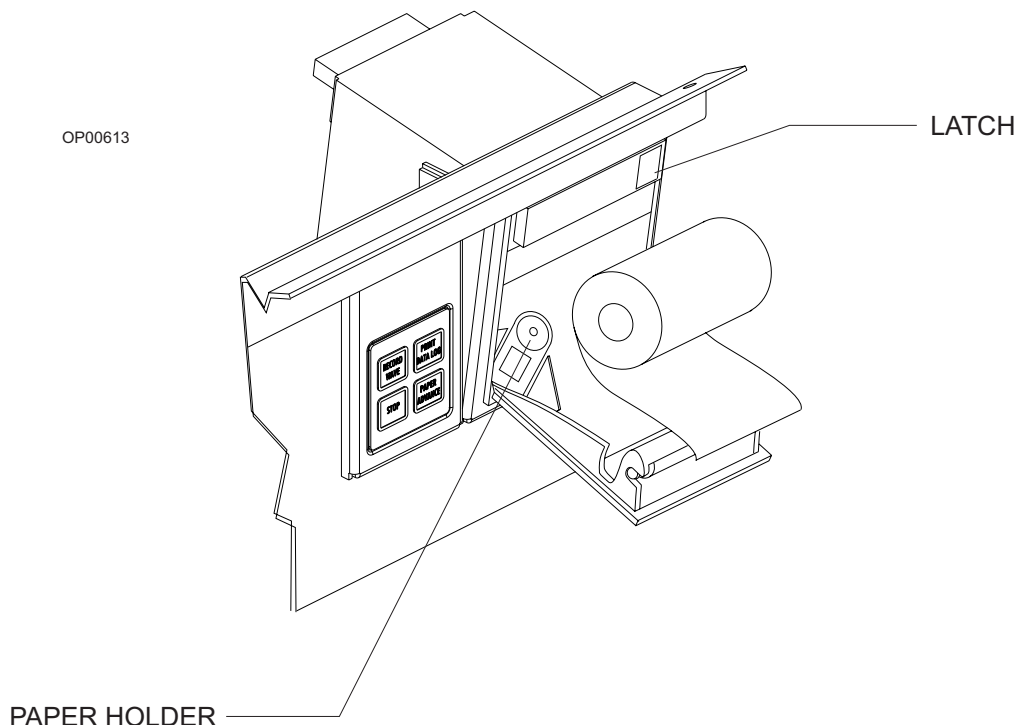


Figure 10-20. Replacing the Strip Chart Recorder Paper

Removing the Footrest (Narkomed 6000 machines)

If the machine is equipped with the optional footrest, it may need to be removed to allow the machine to fit comfortably through doorways. Refer to Figure 10-21 when following this procedure.

Note: This information on the optional footrest applies only to Narkomed 6000 machines. Narkomed 6400 machines have an integrated footrest which is standard equipment and is not removable.

To remove the footrest from the machine:

1. Reach underneath the bottom mounting plate and locate the two pins that secure the footrest to the mounting plate.
2. Pull the rings attached to the pins inward until the pins come out completely.
3. Pull the footrest assembly forward to remove it from the mounting plate.

To replace the footrest on the machine:

1. Align the two bars that extend from the footrest with the two round holes in the front of the bottom mounting plate.
2. Push the bars through the holes at the front of the mounting plate and then through the holes in the rear of the mounting plate until the footrest assembly is flush against the front lip of the mounting plate.
3. To secure the footrest assembly, insert the two pins into the holes on the inside of the two bars. Push the pins through completely until they click into place.

Note: In order for the pins to fit properly, position them so that their rings lie flat against the front lip of the bottom mounting plate.

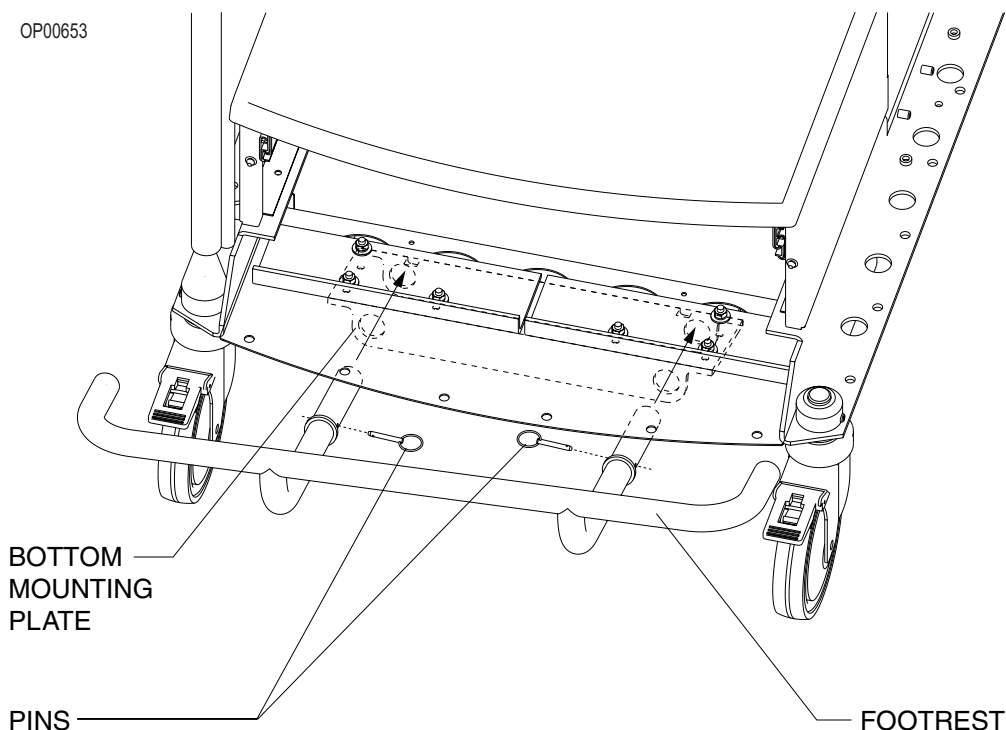


Figure 10-21. Removing/Replacing the Footrest (Narkomed 6000 only)

Replacing the Gas Analysis Pod (GAP-2)

The GAP-2 pod can be replaced while the Narkomed 6400 system is operating. This allows the anesthesia machine to remain functional in the event of a GAP-2 failure during a case.

Draeger Medical recommends the following precautions:

- spare GAP-2 pods should be controlled carefully by the facility.
- before replacing the GAP-2 pod, the clinician should verify that the replacement pod appears to be in good condition. If there is any doubt about the replacement pod's quality, the pod should not be used without first contacting an authorized representative of DrägerService.
- the clinician should perform a complete Narkomed 6400 system self-test as soon as is practical. Full system self-diagnostics will run at that time.

To replace the GAP-2 pod:

1. Remove the patient sample line from the front of the pod being replaced.
2. Unscrew the thumbscrew on the front panel of the pod being replaced.
3. Pull the pod forward and out of the machine just enough to gain access to the rear of the pod.
4. Remove the plastic exhaust hose from the hose barb located on the rear of the pod.

Note: Do not let this hose slip into the machine.

5. Remove the two thumbscrews securing the electrical cable connector to the rear of the pod.

Note: Do not let this cable slip into the machine.

6. Pull the pod completely out of the machine.
7. Insert the replacement GAP-2 pod into the pod slot, allowing access to the rear of the pod. Connect the exhaust hose to the hose barb on the rear of the replacement pod. Ensure that it is on straight and fully seated. Then connect the electrical cable to the rear of the replacement pod using the two thumbscrews. Tighten the thumbscrews and make sure that the cable is on straight and fully seated.
8. Slide the replacement pod fully into the machine until the front panel is flush with the side of the machine. Tighten the thumbscrew on the front panel of the pod.
9. Reconnect the patient sample line to the front panel of the pod.
10. Verify that the GAP-2 pod is functional within 60 seconds of installation.
11. When practical, perform a complete system self-test in order to allow full diagnostics to be run on the GAP-2 pod.

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11

Specifications

This section lists important specifications for the Narkomed 6400.

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Physical Dimensions

Width	34 inches
Height	57 inches
Depth	33 inches
Weight (approximate)	500 lbs

Environmental

Operating	Temperature	15°C to 35°C
	Humidity	40% to 70% relative humidity, noncondensing
Storage	Temperature	-10°C to 50°C
	Humidity	10% to 90% relative humidity, noncondensing

Electrical

Equipment class	IEC 601, Class 1, Type B
Dielectric withstand	≥ 1500 VAC (per UL 544)
Chassis resistance (Chassis to AC ground terminal)	≤ 0.1 ohms
Backup battery charging time	≤ 12 hours
Backup battery reserve power time (from full charge) ..	≥ 30 minutes

120 VAC Voltage Mains

Input voltage	120 VAC $\pm 10\%$, 50/60 Hz
Input current	≤ 12.0 amps (RMS total)
	≤ 9.5 amps (machine)
	≤ 2.5 amps (receptacle)
Leakage current	< 300 microamps (per UL 544)

Touch Screen Display

Dimension	15 inches diagonal
Dot pitch	0.28 mm
Resolution	1024 x 768 pixels, 256 colors

Auxiliary Video Output

Resolution	1024 x 768 (XGA) pixels; 65,536 (16 bit) colors
Video output	VGA 15-contact, high density, metal shell DB-type
	connector with female contacts,
	with means to secure video cable with jackscrews
VGA analog video signal levels	0V to 0.7V peak
Refresh rates	up to 75 Hz at 1024 x 768 resolution & 65,536 colors

Gas Delivery System

Pipeline inlet connections	DISS/male ANSI B57.1-1977
	Nut with nipple (Canada)
Pipeline inlet pressure	50 to 55 psi (345 to 380 kPa)
	(O ₂ , N ₂ O, Air)
Pipeline gauge accuracy	± 3 psi (0 to 25 psi); ± 2 psi (26 to 75 psi);
	± 3 psi (76 to 100 psi)
Cylinder connections	Pin-indexed hanger yokes (CGA V-1-1994)
Regulator safety relief valve	95 psi (655 kPa)
Regulator safety relief valve	75 psi (520 kPa)
	(CSA Standard Z168.3-97)
Fresh gas common outlet	Quick Disconnect,
	compatible with Divan ventilator
Fresh gas oxygen concentration (ORC)	$25 \pm 4\%$
Oxygen flush flow rate	55 (± 10) L/min

	Minimum oxygen flow (at 50 psi pipeline pressure) 150 ± 50 mL/min
	Low oxygen supply pressure alarm. 34 to 40 psi
	Cylinder gauge accuracy ±90 psi (0 to 750 psi); ±60 psi (751 to 2250 psi); ±90 psi (2251 to 3000 psi)
Cylinder Gas Pressures (at 70°F, 21°C)	Oxygen, Air. 2000 psi (13,100 kPa)
	Nitrous oxide 745 psi (5,130 kPa)
Flowmeter Accuracy (at 20°C and 760 mmHg)	Air (fine) 100 to 1000 mL/min ±2.5% FS
	Air (course). 1 to 10 L/min ±5% FS
	Oxygen, Nitrous Oxide (fine). 20 to 500 mL/min ±2.5% FS
	Oxygen, Nitrous Oxide (coarse). 0.6 to 10 L/min ±5% FS @ > 1 L/min; ± 15% of reading @ <1 L/min
	Oxygen (auxiliary oxygen). 1 to 10 L/min ± 5% FS
Electronic Fresh Gas Flow (at 20°C and 760 mmHg)	Display range (air, O ₂ , N ₂ O) 0.0 to 12.0 L/min
	Accuracy (air, O ₂ , N ₂ O) ±10% of reading or 0.12 L/min
	Resolution (air, O ₂ , N ₂ O). 0.1 L/min

Ventilator, Divan

Rate, Volume and Pressure Modes	6 to 80 ± 5% BPM (in 1 BPM increments)
Rate, SIMV Mode.	3 to 80 ± 5% BPM (in 1 BPM increment)
I:E Ratio	1:5 to 5:1 ± 5% (in increments of 0.1)
Inspiratory flow range	5 to 75 L/min
Tidal Volume	10 to 19 mL ± 6 mL; 20 to 100 ml ± 10mL; 110 to 1400 mL ± 5% of value or 15 mL, whichever is greater; Tidal volume in pressure mode ≤ 1400 mL
Pressure limit control range	10 to 80 cmH ₂ O ± 5% of value or 3 cmH ₂ O, whichever is greater
Pressure set control range.	10 to 70 cmH ₂ O ± 5% of value or 3 cmH ₂ O, whichever is greater
PEEP	2.0 to 20 cmH ₂ O ± 2 cmH ₂ O

Minute volume	$\leq 25 \text{ L/min}$
Inspiratory Pause.	$0 \text{ to } 60\% \pm 5\%$
Trigger Pressure (SIMV)	$-1.0 \text{ cmH}_2\text{O} \pm 0.5 \text{ cmH}_2\text{O}$

Breathing System Specifications

Absorber System	Inspiratory valve hose terminal	22 mm male
	Expiratory valve hose terminal.	22 mm male
	APL valve range (Man position).	5 to 70 cmH ₂ O
	Breathing bag hose terminal.	22 mm male
Compliance with Absorber	Value.	approximately 4 mL/cmH ₂ O
Absorber Volume	Value.	1.5 L for absorbent
Pressure Relief	Value.	92 cmH ₂ O
	Accuracy	$\pm 10 \text{ cmH}_2\text{O}$
APL Valve Adjustment	Range	5 to 70 cmH ₂ O
	Accuracy	$\pm 20\%$ of set value or 5 cmH ₂ O, whichever is greater
Ventilation System Leakage	Range	$< 120 \text{ mL/min @ } 30 \text{ cmH}_2\text{O}$
Temperature of Inspiratory Gas at the Y-Piece	Range	$\leq 41^\circ \text{ C}$

Ultrasonic Flow Sensor

Flow Measurement Range.	0 to 120 L/min
Measurement Frequency	100 Hz
Flow Resistance	$< 2 \text{ cmH}_2\text{O}$ at 60 L/min
Operating Media	All normal anesthetic gases except Heliox

Monitoring

Carbon Dioxide	Range	0 to 15% vol, 0 to 114 mmHg, 0 to 150 kPa
	Resolution.	0.1%
	Accuracy	
	(full accuracy).	0.2% abs or 5% rel., whichever is greater
	Noise	< 0.1% abs
Respiration (via CO₂)	Range	0 to 99 BPM
	Accuracy	±2 BPM
Nitrous Oxide	Range at 200 mL/min	0 to 100% vol
	Resolution.	1%
	Accuracy	
	(full accuracy).	3.0% abs
	Noise	< 3.0% abs
Halothane	Range at 200 mL/min.	0 to 7.5% vol
	Resolution.	0.1%
	Accuracy	
	(full accuracy/single agent).	0.2% abs or 5% rel. for 0 to 4%, whichever is greater; 10% rel. for 4% to 7.5%
	Noise	< 0.1% abs
Enflurane	Range at 200 mL/min.	0 to 7.5% vol
	Resolution.	0.1%
	Accuracy	
	(full accuracy/single agent).	0.2% abs or 5% rel. for 0 to 5%, whichever is greater; 10% rel. for 5% to 7.5%
	Noise	< 0.1% abs

Isoflurane	Range at 200 mL/min.	0 to 7.5% vol
	Resolution.	0.1%
	Accuracy (full accuracy/single agent).	0.2% abs or 5% rel. for 0 to 5%, whichever is greater; 10% rel. for 5% to 7.5%
	Noise	< 0.1% abs
Sevoflurane	Range at 200 mL/min.	0 to 9% vol
	Resolution.	0.1%
	Accuracy (full accuracy/single agent).	0.2% abs or 5% rel. for 0 to 6%, whichever is greater; 10% rel. at 6% to 9%
	Noise	< 0.1% abs
Desflurane	Range at 200 mL/min	0 to 20% vol
	Resolution.	0.1%
	Accuracy (full accuracy/single agent)	0.2% abs or 5% rel. for 0 to 15%, whichever is greater; 10% rel. for 15% to 20%
	Noise	< 0.1% abs
Sample Line Flow Rate	Range	60 or 200 mL/min
Agent Identification	Response time	< 30 seconds
	Simultaneous number of agents identified.	2
	Effect of multiple agents	mixture detected with 3 or more agents present
Oxygen	Range	10 to 100 vol% O ₂
	Resolution.	1 vol% O ₂
	Accuracy (When calibrated within 18 hours, and constant temperature and pressure)	± 3 vol% O ₂
	Response time	≤ 25 sec (T90)
	Zero drift.	≤ 0.1vol O ₂ /month

	Span drift $\leq 1 \text{ vol } \% \text{ O}_2 / 8 \text{ hours}$
	Temperature error $\leq \pm 3\%$ of reading (15° to 40° C)
	Sensor service life $\geq 8 \text{ months at } 25^\circ \text{ C,}$ 50% relative humidity, 50% O_2 gas mixture (or $\geq 5000\%$ hour CO_2)
Breathing Pressure	Numeric display range $-10 \text{ to } +100 \text{ cmH}_2\text{O}$
	Resolution $1 \text{ cmH}_2\text{O}$
	Accuracy $\pm 3 \text{ cmH}_2\text{O}$ or $\pm 10\%$ of reading, whichever is greater
Waveform	Display range - full $0 \text{ to } 100 \text{ cmH}_2\text{O}$
	Resolution $1 \text{ cmH}_2\text{O}$
	Accuracy $\pm 3 \text{ cmH}_2\text{O}$ or $\pm 10\%$ of reading, whichever is greater
	Display scales $0 \text{ to } 20, 0 \text{ to } 50, 0 \text{ to } 100 \text{ cmH}_2\text{O}$
Lung Compliance	Accuracy $\pm 20\%$
Respiratory Volume	
Minute Volume	Display Range $0.02 \text{ to } 99.9 \text{ L}$
	Resolution 0.01 L
	Accuracy 10% of reading or $.01 \text{ L} \times \text{respiratory rate}$, whichever is greater
Tidal Volume	Display Range $0.010 \text{ to } 9.990 \text{ L}$
	Resolution $< 1.0\text{L}, 0.001 \text{ L}; \geq 1.0\text{L}, .01\text{L}$
	Accuracy 10% or 0.01 L , whichever is greater
Respiratory Rate	Numeric Display Range $2 \text{ to } 80 \text{ BPM}$
	Resolution 1 BPM
	Accuracy $\pm 10\%$ or 1 BPM , whichever is greater
Expiratory Flow	Waveform display range - full $0\text{-}100 \text{ L/minute}$
	Waveform resolution 1 L/minute
	Waveform display scales $0\text{-}20, 0\text{-}50, 0\text{-}100 \text{ L/minute}$

**Serial
Interface**

Type of ports RS-232/422
Baud rates 1200, 2400, 4800, 9600, 19.2K, 38.4K
Parity Odd, Even, None
Data bits 7 or 8
Stop bits 1 or 2
Protocols Vitalink

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A-1

Tables

Appendix 1 provides details of system information in tabular format.

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Self-Diagnostic Tests

The following self-diagnostic tests are conducted by the Narkomed 6400 when the main switch is powered on or when the main switch is changed from STANDBY to ON position. Power is cycled by the processor to the appropriate ports; however, tests may not occur in this order.

Note: “NA” in column 3 means that the test is not run in this case.

TEST	If Failure detected at power-up, then System is...	If run-time Failure, then System will display
Firmware Test-VPO monitor	NONFUNCTIONAL	NA
Firmware Test - GAP POD	Conditionally FUNCTIONAL	NA
WPU Processor Test	NONFUNCTIONAL	NA
WPU RAM Test	NONFUNCTIONAL	NA
Audio Test - Primary	Conditionally Functional	Advisory posted
Audio Test - Secondary	Conditionally Functional	Advisory posted
Vitalbus Test in VPO monitor	NONFUNCTIONAL	NA
Vitalbus Test in GAP Pod	Conditionally Functional	NA
RAM test in VPO monitor	NONFUNCTIONAL	NA
RAM test in GAP Pod	Conditionally Functional	NA
A/D converter test in VPO monitor	NONFUNCTIONAL	NA
Non-volatile memory test in VPO monitor	NONFUNCTIONAL	NA
Non-volatile memory test in GAP Pod	Conditionally functional	NA
Battery Test	Conditionally functional	Post advisory
O2 Cell Cal Due	NA	Post Advisory
O2 Cell Voltages test	NA	Post Advisory
Sensor disconnect (O2, Volume)	NA	Post Advisory
Volume Sensor Tests	NA	Post Advisories
Host Temperature Test	NA	Post Advisory
Ventilator Cal Due	NA	Post Advisory
Ventilator Powerup Tests	Conditionally Functional	NA
Preventative Maintenance Due	Conditionally Functional	NA

Factory Default Settings

The following tables contain the values stored in the Factory template for various parameters and machine settings (exceptions are noted). They also specify the parameters and settings that can be stored within a Site or user-created template (with the noted exceptions). The specific values for those parameters and settings are determined by the clinician. The values that are invoked automatically at power-up are stored in the Site template.

Parameter	Alarm Limit (High)	Alarm Limit (Low)	Site or Units	Waveform Scale	Limits Display	Units Display	Other
Oxygen	100	30			Off	Off	
CO ₂ Expiratory Inspiratory Cal Delay Period Sample Flow	50 4	8	mmHg	53 mmHg	Off	Off	5 minutes Normal - 200 ml/ min
Breathing Pressure Peak PEEP Apnea Threshold Plateau Display Mean Display	50 6				Off	Off	8 cmH ₂ O Off On
Minute Volume		1.0			Off	Off	
Agent Halothane Isoflurane Enflurane Desflurane Sevoflurane N ₂ O	3.0 3.0 3.0 9.0 6.0	0.0 0.0 0.0 0.0 0.0		10% 50%	Off	Off	Note: the agent scale changes to 20% for Desflurane

System Settings	Value	Notes
Trace Speed Respiratory Waveform	12.5 mm/sec	
Alarm Volume	Minimum	
Countdown Timer Interval Enabled AutoCycle Audio Notify	5 minutes Off Off Off	The Countdown Timer settings cannot be stored within a template. The settings listed here will be restored with each machine power-up or template invocation.
Elapsed Timer Enabled	Off	The Elapsed Timer settings cannot be stored within a template. The settings listed here will be restored with each machine power-up or template invocation.
Pressure Gauge Threshold Enable Audio	20 cmH ₂ O Off	The Pressure Gauge settings cannot be stored within a template. The settings listed here will be restored with each machine power-up or template invocation.
Data Log - Setup Interval Warning Caution Position Font Time Location	5 minutes Off Off Horizontal Small Left	
Data Log - Custom Displayed Columns	All	
Numeric Box Position Lock Volume Agent	Off Off	
Waveform Print Waveform #1 Waveform #2	Pressure None	The Waveform Print settings cannot be stored within a template. The settings listed here will be restored with each machine power-up or by exiting Monitor Standby via [New Case] .
Vent Confirm Tone Volume Level	On 50%	
MAC Display	Off	

System Settings	Value	Notes
Ventilation Sound Selection Volume	None 50%	
N ₂ O Waveform Display	Off	
Screen Configuration Mode	Respiratory Only	
Fresh Gas Flow Flow Threshold Time Delay	4 L/min Off	
CO ₂ Alarm Mode	Limited	
Configurable Trend Window #1 (from top) Window #2 Window #3 Window #4	CPL CO ₂ VOL PAW	
Tidal Volume Alarm	Enabled	The Tidal Volume alarm setting cannot be stored within a template. The setting listed here will be restored with each machine power-up.
Quick Print Time	30 seconds	The setting for Quick Print Time cannot be stored within a template. The last setting will persist until changed by clinician.
External Printer Select Printer	None	The setting for printer selection cannot be stored within a template. The last setting will persist until changed by clinician.

Alarm Management

Alarm management software coordinates conditions originally detected by the gas analyzer or the volume, pressure, and oxygen monitor with information to the processor communicated through the parameter boxes, setup notebook pages, and main screen taskbar control buttons. The clinician does not have to remember where the alarm was originally set to reset it, nor which alarms function under the various ventilator modes.

Alarms at System Initialization

The following table presents the default alarm settings produced during warmup and system initialization.

Alarm Parameter	Alarm Standby	Alarm Disabled When:	Alarm Forced On When:
Agent/N2O	default, until reset by clinician	<ul style="list-style-type: none"> • ventilator in Ventilator Standby Mode • gas line blocked • calibration in progress • gas analysis pod warming up • invalid data being read • CO2/agent error • gas analysis pod communications error 	
Oxygen	not available	<ul style="list-style-type: none"> • O₂ sensor disconnected • monitor error • VPO monitor communications error 	<ul style="list-style-type: none"> • O₂ sensor connected • valid data detected
Pressure	not available; enabled when ventilator in Manual/ Spontaneous Mode	<ul style="list-style-type: none"> • ventilator in Ventilator Standby Mode • monitor error • VPO monitor communications error 	<ul style="list-style-type: none"> • ventilator in Pressure, Volume, or SIMV Mode • ventilator communications error
Volume	default, until reset by clinician; enabled during ventilator communications error	<ul style="list-style-type: none"> • ventilator in Ventilator Standby Mode • monitor error • flow sensor disconnected • VPO monitor communications error 	
CO2	Same as Agent/N2O		

Alarms when New Case Selected

The following table presents exceptions to the Alarm Standby settings produced when the clinician touches **[New Case]** in the Case Selection Dialog Box.

Alarm Parameter	Alarm Standby	Alarm Disabled When:	Alarm Forced On When:
Agent/N2O	default, until reset by clinician	<ul style="list-style-type: none">• ventilator in Ventilator Standby Mode• gas line blocked• calibration in progress• gas analysis pod warming up• invalid data being read• CO2/agent error• gas analysis pod communications error	
Oxygen	not available	<ul style="list-style-type: none">• O₂ sensor disconnected• monitor error• VPO monitor communications error	<ul style="list-style-type: none">• O₂ sensor connected• valid data detected
Pressure	not available; enabled when ventilator in Manual/ Spontaneous Mode	<ul style="list-style-type: none">• ventilator in Ventilator Standby Mode• monitor error• calibration in progress• calibration failure• VPO monitor communications error	<ul style="list-style-type: none">• ventilator in Pressure, Volume, or SIMV Mode
Volume	default, until reset by clinician; enabled during ventilator communications error	<ul style="list-style-type: none">• ventilator in Ventilator Standby Mode• monitor error• flow sensor disconnected• calibration in progress• calibration failure• VPO monitor communications error	
CO2	Same as Agent/N2O		

A-1 Tables

Alarms when Case Resumed

The following table presents exceptions to the return of original alarm settings produced when the clinician touches **[Resume]** in the Case Selection Dialog Box.

Alarm Parameter	Alarm Returns to Original Setting	Alarm Disabled When:	Alarm Forced On When:
Agent/N2O	default, until reset by clinician	<ul style="list-style-type: none"> • ventilator in Ventilator Standby Mode • gas line blocked • calibration in progress • gas analysis pod warming up • invalid data being read • CO2/agent error • gas analysis pod communications error 	
Oxygen	not available	<ul style="list-style-type: none"> • O₂ sensor disconnected • monitor error • VPO monitor communications error 	<ul style="list-style-type: none"> • O₂ sensor connected • valid data detected
Pressure	not available; enabled when ventilator in Manual/ Spontaneous Mode	<ul style="list-style-type: none"> • ventilator in Ventilator Standby Mode • monitor error • calibration in progress • calibration failure • VPO monitor communications error 	• ventilator in Pressure, Volume, or SIMV Mode
Volume	default, until reset by clinician; enabled during ventilator communications error	<ul style="list-style-type: none"> • ventilator in Ventilator Standby Mode • monitor error • flow sensor disconnected • calibration in progress • calibration failure • VPO monitor communications error 	
CO2	Same as Agent/N2O		

Parameter Box Alarm Management

The following table presents the availability of alarm management through the parameter boxes. If the **[Alarm Suspend]** mode had been in effect, touching the alarm icon in the parameter box cancels it.

Alarm Parameter	Alarm Change Unavailable
Agent/N2O	<ul style="list-style-type: none"> • ventilator in Ventilator Standby Mode • gas line blocked • calibration in progress • gas analysis pod warming up • invalid data being read • CO2/agent error • gas analysis pod communications error
Oxygen	clinician cannot change oxygen alarms
Pressure	<ul style="list-style-type: none"> • ventilator not in Manual/Spontaneous Mode • monitor error • VPO monitor communications error
CO2	Same as Agent/N2O

A-1 Tables

Alarm Displays

Visual Display

Alarm Level	Indicators - Unsilenced	Indicators - Silenced
Warning	ON - red background with white text; FLASHING @ 1.4Hz OFF - black background with white text	ON - red background with white text; NOT FLASHING
Caution	ON - yellow background with black text; FLASHING @ 0.7Hz OFF - white background with black text	ON - yellow background with black text; NOT FLASHING
Advisory	ON - white background with black text; NO FLASHING	

Additional Alarm Conditions

Warnings/Cautions

Pre-Existing Warning or Caution	New Warning or Caution	Narkomed 6400 Response
No active alarm	New alarm	Alarm window pops up and the alarm message is posted.
Active alarm	New alarm	Alarm window expands and the alarm message is posted.
Silenced alarm	New alarm	Alarm window expands and the alarm message is posted.
Active alarm	[Alarm Silence] button pressed	Alarm window messages stop flashing and tone is silenced. Processor starts a 60-second period to re-instate alarms.
Silenced alarm	[Alarm Silence] button pressed	Processor starts a 120-second period to re-instate alarms.
Active alarm or silenced alarm	Pre-existing condition is resolved	Alarm window erases resolved alarm condition and contracts to fit remaining alarms. Alarm window closes if no alarms.

Advisories

Pre-Existing Alarm Window Condition	New Condition	Narkomed 6400 Response when no ALARM SUSPEND
Alarm window minimized	New advisory	Alarm window expands to show all alarms and advisories and the new advisory message is posted at the top of the advisory list.
Alarm window maximized	New advisory	New advisory message is posted at the top of the advisory list.
Alarm window minimized	Clinician touches the window maximize icon	Alarm window expands to show all advisories.
Alarm window maximized	Clinician touches the window minimize icon	Alarm window contracts to hide all current advisories. A Title bar remains if no alarms are posted.

Pre-Existing Alarm Window Condition	New Condition	Narkomed 6400 Response with ALARM SUSPEND
Active alarm, silenced alarm or no active alarms; Alarm window minimized	[Alarm Suspend] button pressed	Eliminate all audible alarms except those for O ₂ and pressure (ventilator Pressure, Volume and SIMV Modes) and advisory annunciation. Alarm Suspend alarm message is posted in the alarm window at the top of the advisory portion of list. Warning and caution messages erased except those for O ₂ and pressure (ventilator Pressure, Volume and SIMV Modes).
Active alarm & alarms suspended	[Cancel Alarm Suspend] button pressed	Alarms re-instated; audible and visual annunciation resumed. "ALARM SUSPEND" message erased. Alarm window expands.
ALARM SUSPEND displayed	Clinician presses the window minimize icon	Alarm window contracts to hide all current advisories except ALARM SUSPEND.

Alarm Suspend Conditions

The first two tables below summarize the alarms annunciated under various ventilator conditions, when the **[Alarm Suspend]** control button has not been activated.

A-1 Tables

When the ventilator mode is changed from Standby to one of the following ventilator modes, the alarm state for each parameter changes as shown:

Parameter/ Ventilator Mode	Ventilator in Pressure, Volume or SIMV Mode	Ventilator in Manual/ Spontaneous Mode	Ventilator communi- cations out of service
Breathing Pressure	annunciators ON	annunciators ON	annunciators ON
Volume	annunciators ON	annunciators ON	annunciators ON
CO ₂	annunciators STBY	annunciators STBY	no change
Agent	annunciators STBY	annunciators STBY	annunciators STBY

When the ventilator mode is changed from Pressure, Volume, SIMV, or Manual/Spontaneous mode to one of the following ventilator modes, the alarm state for each parameter changes as shown:

Parameter / Ventilator Mode	Ventilator Standby (no breathing possible)	Ventilator in Pressure, Volume or SIMV Mode	Ventilator in Manual/ Spontaneous Mode	Ventilator communi- cations out of service
Breathing Pressure	annunciators OFF	annunciators ON	annunciators ON	annunciators ON
Volume	annunciators OFF	no change	no change	no change
CO ₂	annunciators OFF	no change	no change	no change
Agent	annunciators OFF	no change	no change	no change

If the ventilator mode changes when the **[Alarm Suspend]** control button has not been activated, then the status of the parameter alarms changes as above. By comparison, the following table summarizes the alarms the clinician is permitted to suspend, depending upon ventilator status. Actual use of the **[Alarm Suspend]** control button may depend on institutional requirements.

Parameter / Ventilator Mode	Ventilator Standby (no breathing possible)	Ventilator in Pressure, Volume or SIMV Mode	Ventilator in Manual/ Spontaneous Mode	Ventilator communi- cations out of service
Breathing Pressure	annunciators OFF	annunciators ON	annunciators OFF	annunciators ON
Volume	annunciators OFF	annunciators OFF	annunciators OFF	annunciators OFF
CO ₂	no change	no change	no change	no change
Agent	annunciators OFF	annunciators OFF	annunciators OFF	annunciators OFF

Summary of Alarm Messages and Indicators

Message Displayed in Alarm Box	Priority	Alarm Condition	Source of Data	Analyzer
INSP O2 LOW	Warning	Oxygen concentration below low limit	Patient	VPO
INSP O2 HIGH + single audible tone	Advisory	Oxygen concentration greater than high limit	Patient	VPO
O2 SENSOR DISC +single audible tone	Advisory	Oxygen sensor disconnected	NM 6400	VPO
O2 CAL DUE	Advisory	Oxygen sensor should be calibrated (more than 18 hours have passed since calibrated)	NM 6400	VPO
O2 CAL ERROR	Advisory	Oxygen sensor fails voltage measurement tests	NM 6400	VPO
APNEA - PRESSURE	Warning	Pressure apnea detected for over 30/60 seconds (longer when ventilator is in Manual/Spontaneous Mode)	Patient	VPO
APNEA - PRESSURE	Caution	Pressure apnea detected for over 15/30 seconds (longer when ventilator is in Manual/Spontaneous Mode)	Patient	VPO
VENT PRES HI	Warning	Ventilation pressure over the high limit	Patient	VPO
SUB ATM PRES	Warning	Ventilation pressure under -10 cmH ₂ O	NM 6400	VPO
CONTINUOUS PRES	Warning	Pressure above threshold for over 15 seconds (continuous pressure)	NM 6400	VPO
PEEP > 25	Caution	PEEP greater than 25 cmH ₂ O	Patient	VPO
P-SET NOT MET +single audible tone	Advisory	Pset not delivered by ventilator	NM 6400	VPO
PRESSURE LIMIT	Advisory	Pressure limit reported by ventilator AND measured tidal volume is less than 85% of ventilator tidal volume set point	NM 6400	VPO
THRESHOLD LOW (this message is displayed in the breathing pressure parameter box)	Advisory	The current threshold pressure alarm limit is 4 cmH ₂ O or more below the optimal threshold position.	NM 6400	VPO
PEEP HIGH	Advisory	PEEP greater than high limit	Patient	VPO
none - bell icon changes	-	Pressure alarms disabled	NM 6400	CPU
APNEA - VOLUME	Warning	Volume apnea detected, over 30/60 seconds (longer when ventilator is in Manual/Spontaneous Mode)	Patient	VPO

A-1 Tables

Message Displayed in Alarm Box	Priority	Alarm Condition	Source of Data	Analyzer
APNEA - VOLUME	Caution	Volume apnea detected, over 15/30 seconds (longer when ventilator is in Manual/Spontaneous Mode)	Patient	VPO
MIN VOL LOW	Caution	Minute volume under low limit	Patient	VPO
TIDAL VOLUME LOW + single audible tone	Advisory	Patient's exhaled volume is more than 30% below the ventilator tidal volume setting. Patient's exhaled volume is more than 15% below the ventilator setting if this alarm occurs during a PRESSURE LIMIT and/or a FRESH GAS LOW alarm condition.	Patient	VPO
REVERSE FLOW + single audible tone	Advisory	Reverse flow over 20 mL (VT \geq 50 mL) over 9 mL (VT < 50 mL)	NM 6400	VPO
VOL SENSOR DISC + single audible tone	Advisory	Volume sensor disconnected	NM 6400	VPO
none - bell icon changes	-	Volume alarms disabled	NM 6400	CPU
none - bell icon changes	-	Volume alarms in standby	NM 6400	CPU
SERVICE VOL	Advisory	Service required, cannot read volume sensor inputs	NM 6400	VPO
O2 SUPPLY LOW	Caution	Oxygen supply pressure under 34 psi	NM 6400	CPU
AC/BATTERY FAIL	Caution	AC failure and battery low	NM 6400	CPU
AC POWER FAIL + single audible tone (Note: Power Fail dialog is also displayed on screen with Warning tone)	Advisory	AC failure	NM 6400	CPU
BATTERY LOW	Advisory	Battery charge is low	NM 6400	CPU
SERVICE SPEAKER	Advisory	Speaker failure detected (no current through primary speaker)	NM 6400	CPU
VENT FAILURE	Warning	Ventilator failure; ventilator operating in safe state	NM 6400	VPO
VENT COMM ERR	Warning	Ventilator communications failure	NM 6400	VPO
VOL SENS ERR + single audible tone	Advisory	Volume sensor error	NM 6400	VPO
VENT FAN ERR + single audible tone	Advisory	Ventilator fan problem	NM 6400	VPO

Message Displayed in Alarm Box	Priority	Alarm Condition	Source of Data	Analyzer
VENT STANDBY + single audible tone	Advisory	Ventilator in Standby	NM 6400	VPO
VENT TEST DUE	Advisory	No ventilator self-test for more than 10 days	NM 6400	CPU
APNEA-CO2	Warning	CO ₂ apnea detected, over 30/60 seconds (longer when ventilator is in Manual/Spontaneous mode)	Patient	GAP
APNEA-CO2	Caution	CO ₂ apnea detected, over 15/30 seconds (longer when ventilator is in Manual/Spontaneous mode)	Patient	GAP
ET CO2 LOW	Caution	End Tidal CO ₂ low	Patient	GAP
ET CO2 HIGH	Caution	End Tidal CO ₂ high	Patient	GAP
INSP CO2 HIGH	Caution	Inspiratory CO ₂ high	Patient	GAP
CO2 ALARMS OFF	Advisory	CO ₂ alarm state is OFF	NM 6400	GAP
LINE BLOCK	Advisory	Sample line blocked to GAP	NM 6400	GAP
AGT WARMUP	Advisory	Gas analyzer warming up	NM 6400	GAP
SERVICE GAP	Advisory	Service required, GAP	NM 6400	GAP
% HAL HIGH	Warning	Agent very high - Halothane	Patient	GAP
% ENF HIGH	Warning	Agent very high - Enflurane	Patient	GAP
% ISO HIGH	Warning	Agent very high - Isoflurane	Patient	GAP
% SEVO HIGH	Warning	Agent very high - Sevoflurane	Patient	GAP
% DES HIGH	Warning	Agent very high - Desflurane	Patient	GAP
% HAL HIGH	Caution	Agent high - Halothane	Patient	GAP
% ENF HIGH	Caution	Agent high - Enflurane	Patient	GAP
% ISO HIGH	Caution	Agent high - Isoflurane	Patient	GAP
% SEVO HIGH	Caution	Agent high - Sevoflurane	Patient	GAP
% DES HIGH	Caution	Agent high - Desflurane	Patient	GAP
% HAL LOW	Caution	Agent low - Halothane	Patient	GAP
% ENF LOW	Caution	Agent low - Enflurane	Patient	GAP
% ISO LOW	Caution	Agent low - Isoflurane	Patient	GAP
% SEVO LOW	Caution	Agent low - Sevoflurane	Patient	GAP
% DES LOW	Caution	Agent low - Desflurane	Patient	GAP
MAC HIGH	Caution	Total MAC value exceeds 3.0	Patient	GAP
2ND AGENT	Advisory	Two agents were detected	NM 6400	GAP

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Message Displayed in Alarm Box	Priority	Alarm Condition	Source of Data	Analyzer
AGENT MIX + single audible tone	Advisory	A mix of more than two agents was detected	NM 6400	GAP
WPU TEMP HIGH + single audible tone	Advisory	Temperature high in WPU	NM 6400	CPU
GAP FAN FAILURE + single audible tone	Advisory	Fan failure in GAP	NM 6400	GAP
VPO COMM LOST	Warning	Communications lost with VPO monitor	NM 6400	CPU
GAP COMM LOST	Advisory	Communications lost with GAP pod	NM 6400	CPU
SCR COMM LOST	Advisory	Communications lost with Strip Chart Recorder	NM 6400	CPU
DC POWER FAIL + single audible tone	Advisory	Ventilator DC power bad	NM 6400	CPU
ALARMS SUSPEND	Advisory	Alarm suspend	NM 6400	CPU
FRESH GAS HIGH + single audible tone	Advisory	Fresh gas usage exceeded alarm threshold	NM 6400	VPO
FRESH GAS LOW	Caution	Fresh gas low condition reported by ventilator	NM 6400	VPO
SERVICE O2 MON	Advisory	Oxygen zero calibration values are invalid	NM 6400	VPO

Summary of Ventilator Control Panel Information

The following table provides a summary of ventilator control panel information available during each ventilator mode.

Ventilator Mode	Piston Movement	Pmax	Vt	BPM	Alphanumeric Display
Standby	none	none	none	none	Standby
Man/Spont, APL valve in Man position	none	none	none	none	Manual/Spont.
Man/Spont, APL valve in Spont position	none	none	none	none	Manual/Spont.
Volume	moving	value	value	value	PEEP=___ cmH2O
Pressure	moving	value	none	value	PEEP=___ cmH2O
SIMV	moving	value	value	value	SIMV Rate=___/min

Flow Sensor Failure

If the flow sensor fails during self-test, then the following alarm messages provide troubleshooting information.

Occurrence	Alarm Message Displayed
12 V Failure	SERVICE VOL
NVRAM Failure	SERVICE VOL
Healthcheck Failure	SERVICE VOL
Ultrasonic Failure	VOL SENS ERR
Volume Sensor Cable Disconnect	VOL SENSOR DISC

Allowable Waveform Export Tables (Surgeon Display Controller)

The tables below are used to determine the number of simultaneous waveforms that can be exported by the Narkomed 6400 for display on the surgeon display.

Each type of waveform is assigned a bandwidth budget allocation value (first table below). These waveform values are added together to determine whether a particular waveform combination is permitted.

Waveform	Waveform Budget Allocation Value
ECG 1 ECG 2	4
IBP1 IBP2 IBP3 IBP4	2
SPO2 CO2 Pressure Flow Agent N2O	1

The total of the budget values for any combination of waveforms may not exceed the values specified in the table below, based on baud rate and line setting configuration.

Note: A minimum baud rate of 9600 is required for waveform export.

Allowable Waveform Export Combinations (maximum number of budget values)									
	Parity:	N81	N71	N82	N72	P81	P71	P82	P72
Baud:									
9600		4	4	3	3	3	3	3	3
19200		8	8	7	7	7	7	6	6
38400		18	18	15	15	15	15	13	13

Printer Drivers/Models Supported by the Narkomed 6400

Printer Driver	Selection Name	Printer Models	
HPBF3122.DLL	HP LJ1200 Series	HP Laserjet 1200 Series	
HPPCL.DLL	HP PCL	Brother HL-4 Brother HL-630 Brother HL-8 Brother HL-8D Brother HL-8e Digital DEClaser 1100 (LJ) Digital DEClaser 2100plus (LJ) Digital DEClaser 2200plus (LJ) Digital DEClaser 3200 (LJ) Epson ActionLaser 1000 Epson ActionLaser II Epson EPL-4000 Epson EPL-5000 Epson EPL-6000 Epson EPL-7000 Epson EPL-7100 Epson GQ-3500 Hermes H 606 HP LaserJet HP LaserJet 2000 HP LaserJet 500+ HP LaserJet IID HP LaserJet IIP HP LaserJet IIP Plus HP LaserJet Plus HP LaserJet Series II Kodak EktaPlus 7016 NEC Silentwriter LC 860 NEC Silentwriter LC 860 Plus OKI OL-400 Oki OL-600ex OKI OL-800/840	Okidata LaserLine 6 Okidata OL-400 Okidata OL-600e Okidata OL-800 Olivetti ETV 5000 Olivetti PG 108 Olivetti PG 208 M2 Olivetti PG 306 Olivetti PG 308 Olivetti PG 308 HS Panasonic KX-P4410 Panasonic KX-P4420 Panasonic KX-P4450 Panasonic KX-P4450i QuadLaser I Sharp JX-9300 Sharp JX-9500 Sharp JX-9500E Sharp JX-9500H Sharp JX-9700 Star LaserPrinter 4 Star LaserPrinter 5 Star LaserPrinter 8 Star LaserPrinter 8 DB Star LaserPrinter 8 DX Star LaserPrinter 8 II Tandy LP-1000 Tegra Genesis Toshiba PageLaser12 Triumph Adler SDR 7706 Unisys AP9210 Wang LDP8

(continued on next page)

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Printer Driver	Selection Name	Printer Models	
PCL5MS	PCL 5	Brother HL-10DV Brother HL-10V Brother HL-4V Brother HL-4Ve Brother HL-6V Brother HL-8V Bull Compuprint PageMaster 1025 Bull Compuprint PageMaster 413 Bull Compuprint PageMaster 815 Bull Compuprint PageMaster 825 Canon LBP-430 Canon LBP-4i Canon LBP-4sx Canon LBP-8sx Citizen ProLaser 6000 Compaq PageMarq 15 Compaq PageMarq 20 Digital DEClaser 1800 (PCL) Digital DEClaser 3500 (PCL) Epson ActionLaser 1500 Epson EPL-4200 Epson EPL-4300 Epson EPL-5200 Epson EPL-8000 Epson EPL-8100 HP DeskJet 850C HP DeskJet 855C HP LaserJet III HP LaserJet IIID HP LaserJet IIIP HP LaserJet IIISi	HP PaintJet XL 300 IBM 4039 LaserPrinter Lexmark ValueWriter 600 Mannesmann Tally MT 904 Plus Mannesmann Tally MT 908 Mannesmann Tally T9005 Plus Mannesmann Tally T9017 Minolta SP 3000 Minolta SP 3500 NEC Silentwriter S102 Oki OL-410 Oki OL-410ex Oki OL-810 Oki OL-870 Okidata OL-410e Okidata OL-810 Olivetti PG 404 Olivetti PG 408 Panasonic KX-P4430 Panasonic KX-P4440 Panasonic KX-P4451 Ricoh LP-1200 Sharp JX-9460 Sharp JX-9600 Sharp JX-9660 Sharp JX-9700E Star LaserPrinter 4 III Star LaserPrinter 5 EX Star LaserPrinter 8 III TI microLaser 600 Toshiba GX-400

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User-Replaceable Parts

This section lists spare and replacement parts for the Narkomed 6400.

Spare Components	A-2-2
Vaporizers (19.3)	A-2-2
Gas Evacuation Systems	A-2-2
Patient Suction Systems	A-2-2
Power Management	A-2-3
Boom Arm	A-2-3
Manuals	A-2-3
Absorber	A-2-3
Breathing System Accessories	A-2-3
Gas Evacuation Accessories	A-2-3
Respiratory Gas Monitoring	A-2-3
Interface Cables	A-2-3
Auxiliary Video Output Accessories	A-2-4
Side-Mount Accessories	A-2-4
Printer Paper	A-2-4
Drawer Storage	A-2-4
Training	A-2-4

	Part or Assembly	Part Number
Spare Components	Breathing System Assembly	4114852
	Flow Sensor Assembly	4115754
	Transducer Component	4114445
	Flow Housing Component	4114444
	Flow sensor O-ring set	4115147
	Hexagon Screw Driver	1640623
	Piston assembly	AF00500
	Absorbent canister	M29320
	Bag Arm Lock Knob	4115758
Vaporizers (19.3)	Halothane w/ funnel fill	4115032-002
	Enflurane w/ funnel fill	4115032-001
	Isoflurane w/ funnel fill	4115032-003
	Sevoflurane w/ funnel fill	4115032-004
	Halothane w/ key fill	4115005-002
	Key index filler tube (Halothane)	4109304
	Enflurane w/ key fill	4115005-001
	Key index filler tube (Enflurane)	4109303
	Isoflurane w/ key fill	4115005-003
	Key index filler tube (Isoflurane)	4109302
	Sevoflurane w/ key fill	4115005-004
	Key index filler tube (Sevoflurane)	4114876
	Sevoflurane w/ Abbott quick fill	4115031
Gas Evacuation Systems	Passive Scavenger	4106161
	Open Reservoir Scavenger	4107624-003
Patient Suction Systems	Suction assembly with reusable glass canister	4106328-001
	Suction assembly with disposable plastic canister	4112647-002
	Disposable suction system canister	4112645-001
	Suction bracket assembly	4118593

Power Management	Outlet strip (6 additional outlets with 15 ft. power cord) . . . 4112267
Boom Arm	Patient line boom arm 4114926
Manuals	Narkomed 6400 Operator's Manual (this manual)4117965-001
	Narkomed 6400 Binder and Instruction Manual Assembly (includes Narkomed 6400 Operator's Manual) 4118068
	Narkomed 6000 Series Service Manual4114846-001
	Narkomed 6000 Series Service Binder Assembly (includes Narkomed 6000 Series Service Manual)4112817-012
Absorber	Dragersorb absorbent (10 liter container) 6750801
Breathing System Accessories	Corrugated breathing hose, 32 in. with 22 mm bushings (for connection to bag arm) 9995132
	Rubber good set 1101071
	Breathing Pressure Gauge Option Kit 4117271
Gas Evacuation Accessories	Hose, 30 in. with 19 mm bushings 9995230
Respiratory Gas Monitoring	Oxygen sensor capsule. 6850645
	Oxygen sensor housing and cable assembly. 4106363
	Luer airway adaptor 4108104
	Disposable water trap (1) 4118128
	Disposable water trap (box of 12) 6870567
	Patient sample line 4108103
	Semi-permeable tube 4115961
Interface Cables	Vitalink cable (2.5 ft.) 4110328

A-2 User-Replaceable Parts

Auxiliary Video Output Accessories	Auxiliary Video Output Wall Mount Kit.	4117800
	Auxiliary Video Output Machine Mount Kit	4117801
	Isolation transformer.	4114985
	Video cable, 5 ft.	4117781-005
	Video cable, 50 ft.	4117781-050
	Video cable, 100 ft.	4117781-100
	Flat panel display, 20-inch diagonal	4117789
	Specification - Flat Panel Display - Auxiliary Video Output.	4117821
Side-Mount Accessories	Clipboard holder.	4114999
	Glove box holder, adjustable	4114994
	Large container	4114995
	Medium container	4114996
	Wire basket.	4114997
	Pivot arm accessory tray	4117486
Printer Paper	Paper for Strip Chart Recorder.	4110335
Drawer Storage	Stationary drawer divider	4115000
	Removable drawer divider trays (set of 2)	4115001
Training	Biomed training seminar, (Telford PA).	SV00400

A-3

Optional Accessory Mounting Systems

This section specifies the permitted configurations for optional accessory mounting systems for the Narkomed 6400.

A-3 Optional Accessory Mounting Systems

Narkomed 6400 Permitted Configurations for Optional Accessory Mounting Systems

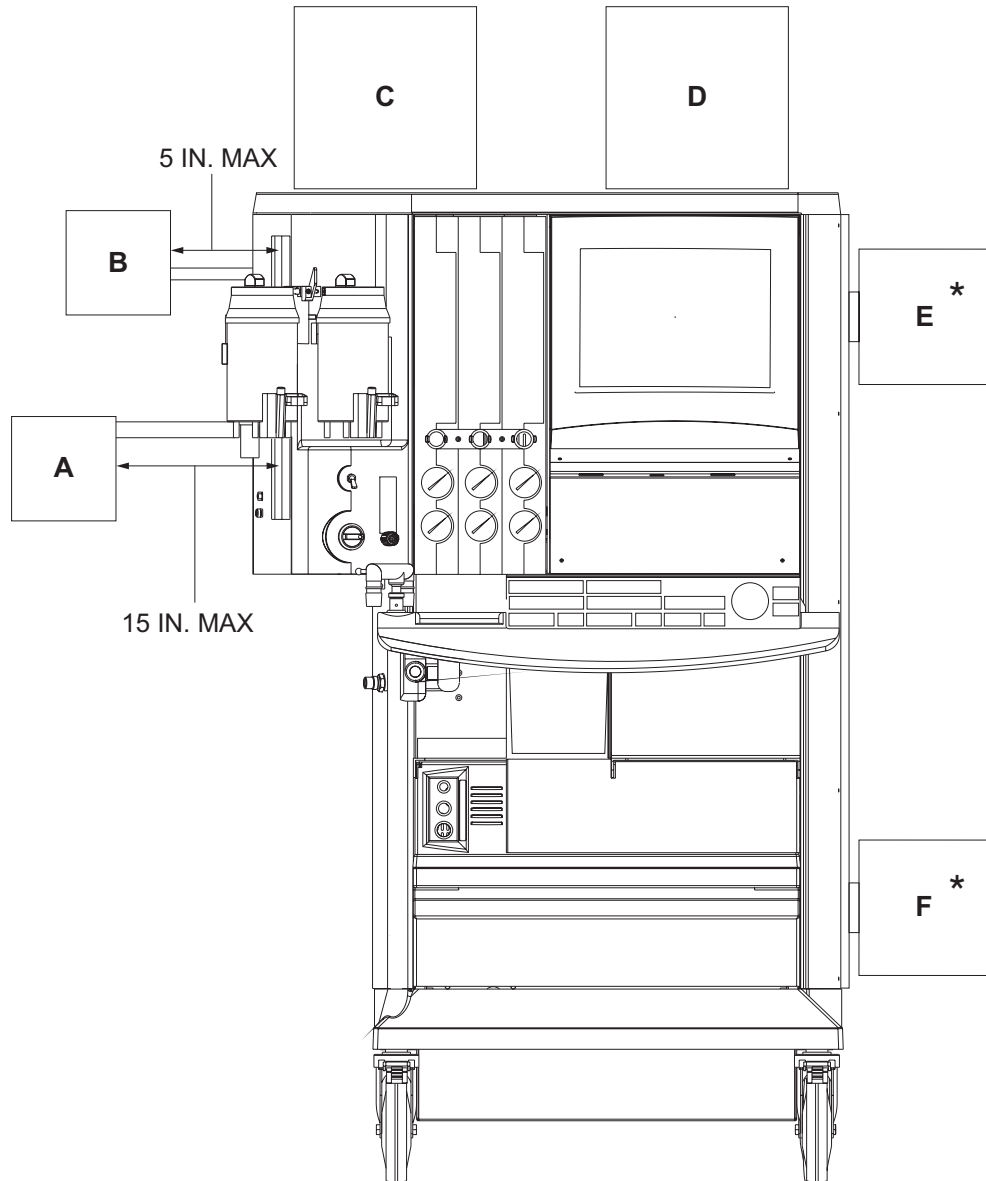
Optional mounting systems are available for the Narkomed 6400 anesthesia system allowing the user convenient positioning of monitors and accessories. Each line in the following table lists the permitted configurations of weight distribution for components installed on the Narkomed 6400.

Warning: Only configure the Narkomed 6400 using one of the permitted combinations listed below. Use of any other configuration may create a tip hazard.

Refer to Figure A-3-1 for location of the mounting options. Determine the weight of the item to be installed at Location A first, and then find that weight in the Location A column of the table. The remaining columns indicate the required weights at Locations B through F. User configuration must match weights across one complete row of the table below.

Note: If a machine has the three vaporizer mount option (which covers Location B), then only rows with 33 lbs/14.8 kg in Location B are permitted configurations for that machine.

Location A		Location B		Location C		Location D		Location E		Location F	
lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
0	0	33	14.8	26	11	42	19	0	0	0	0
8	3.6	33	14.8	12	5.4	0	0	0	0	0	0
8	3.6	33	14.8	26	11	42	19	0	0	0	0
17	7.6	0	0	42	19	22	10	0	0	0	0
17	7.6	33	14.8	0	0	14	6.3	6	2.7	22	10
17	7.6	33	14.8	22	10	42	19	0	0	0	0
17	7.6	33	14.8	42	19	0	0	0	0	22	9
20	9	33	14.8	0	0	0	0	0	0	0	0
20	9	33	14.8	22	10	42	19	0	0	0	0
20	9	33	14.8	42	19	0	0	22	10	0	0
20	9	37	16.6	0	0	0	0	0	0	0	0
22	10	33	14.8	0	0	0	0	22	10	0	0
22	10	33	14.8	0	0	22	10	0	0	0	0
22	10	33	14.8	0	0	0	0	0	0	22	10
22	10	33	14.8	14	6.3	22	10	0	0	0	0
22	10	33	14.8	14	6.3	0	0	22	10	0	0
22	10	33	14.8	14	6.3	0	0	0	0	22	10
22	10	33	14.8	14	6.3	22	10	4	1.8	0	0
25	11.3	0	0	0	0	31	14	24	10.8	21	9.5
25	11.3	0	0	31	14	28	12.6	0	0	0	0
25	11.3	0	0	31	14	0	0	0	0	21	9.5
38	17	0	0	0	0	0	0	24	10.8	21	9.5
38	17	0	0	28	12.6	0	0	0	0	0	0



* MOUNT FLUSH ONLY WITH NO EXTENSION

OP00121

Figure A-3-1. Locations of Mounting Options

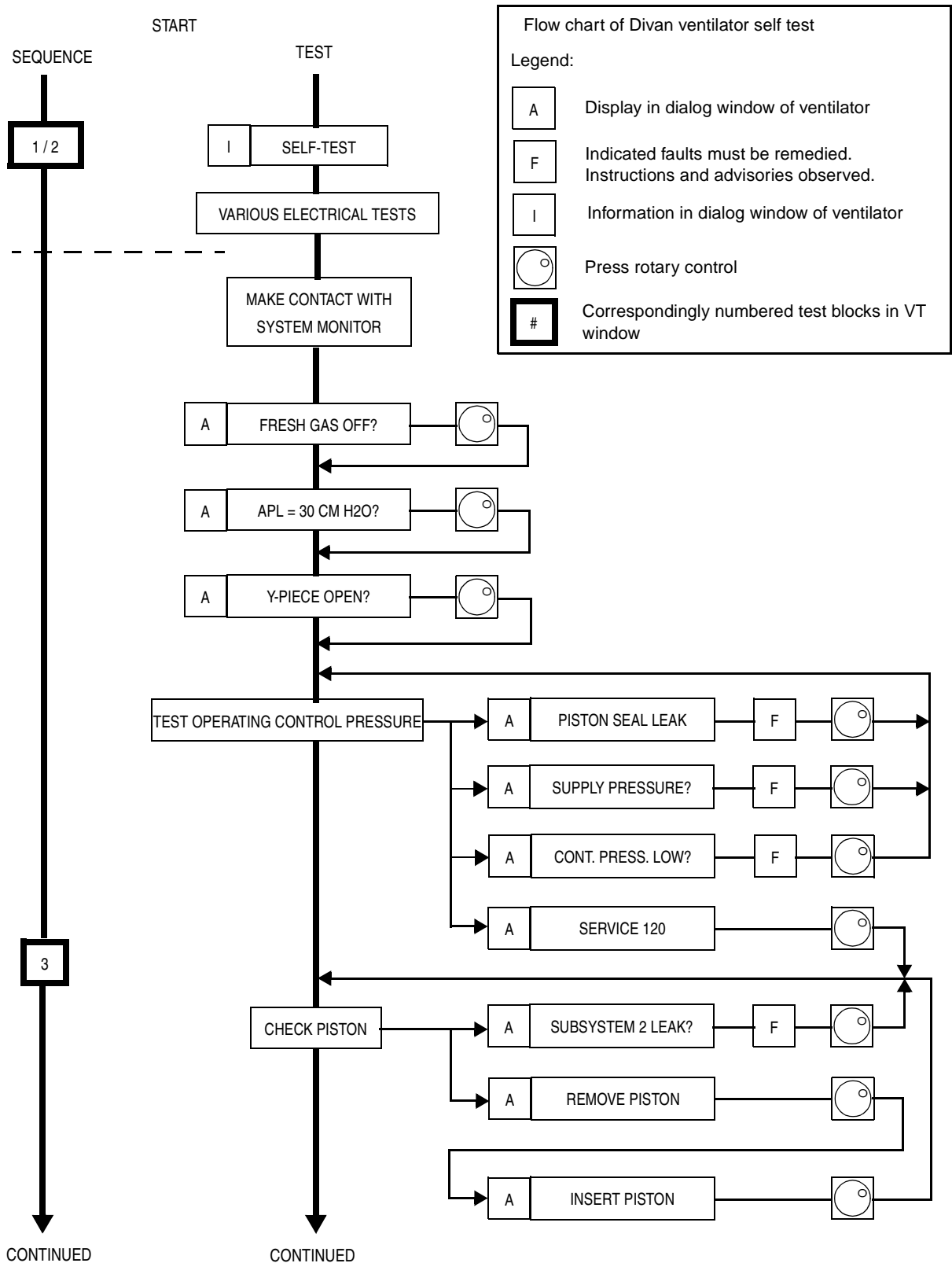
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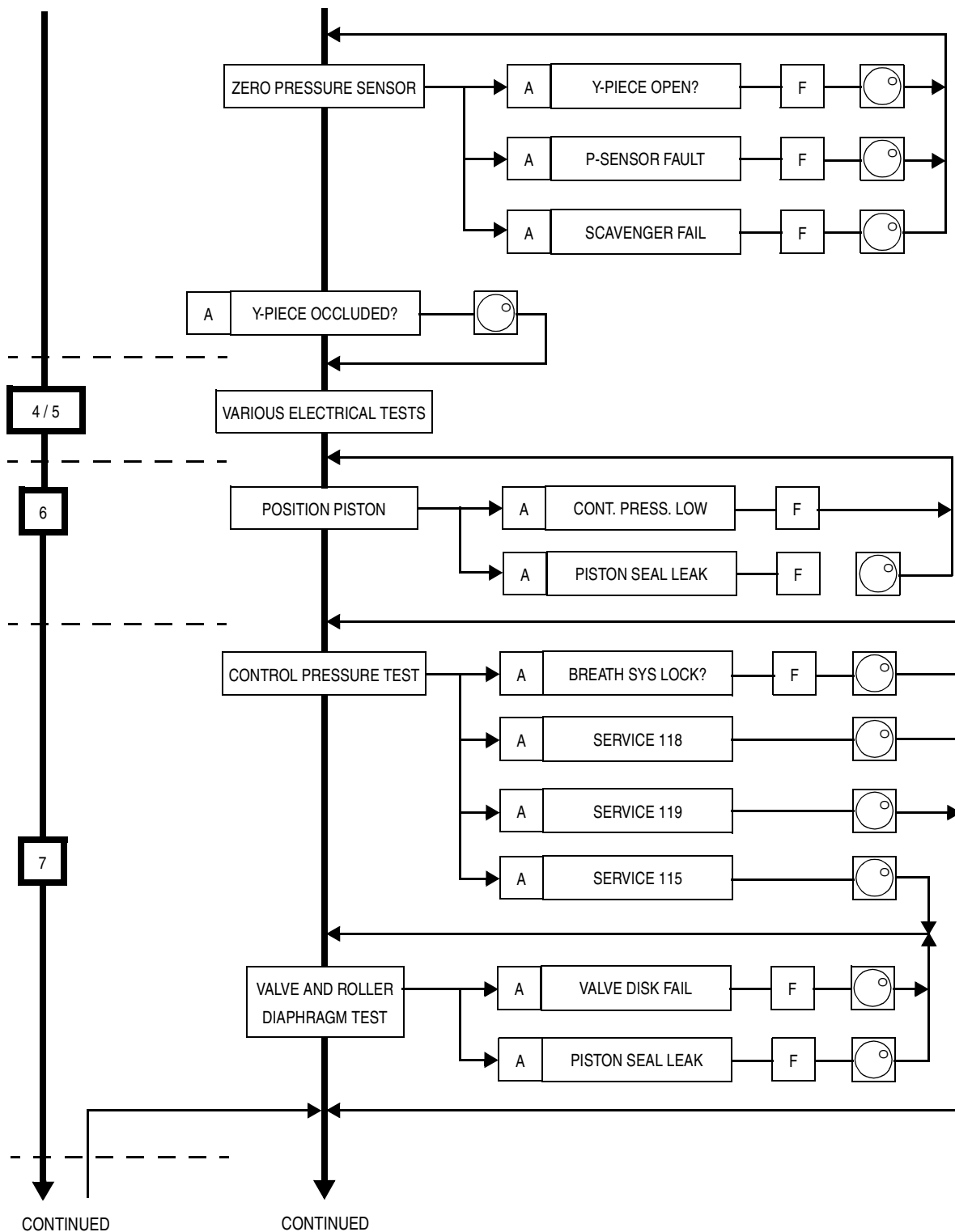
A-4

Divan Ventilator Self-Test Flow Chart

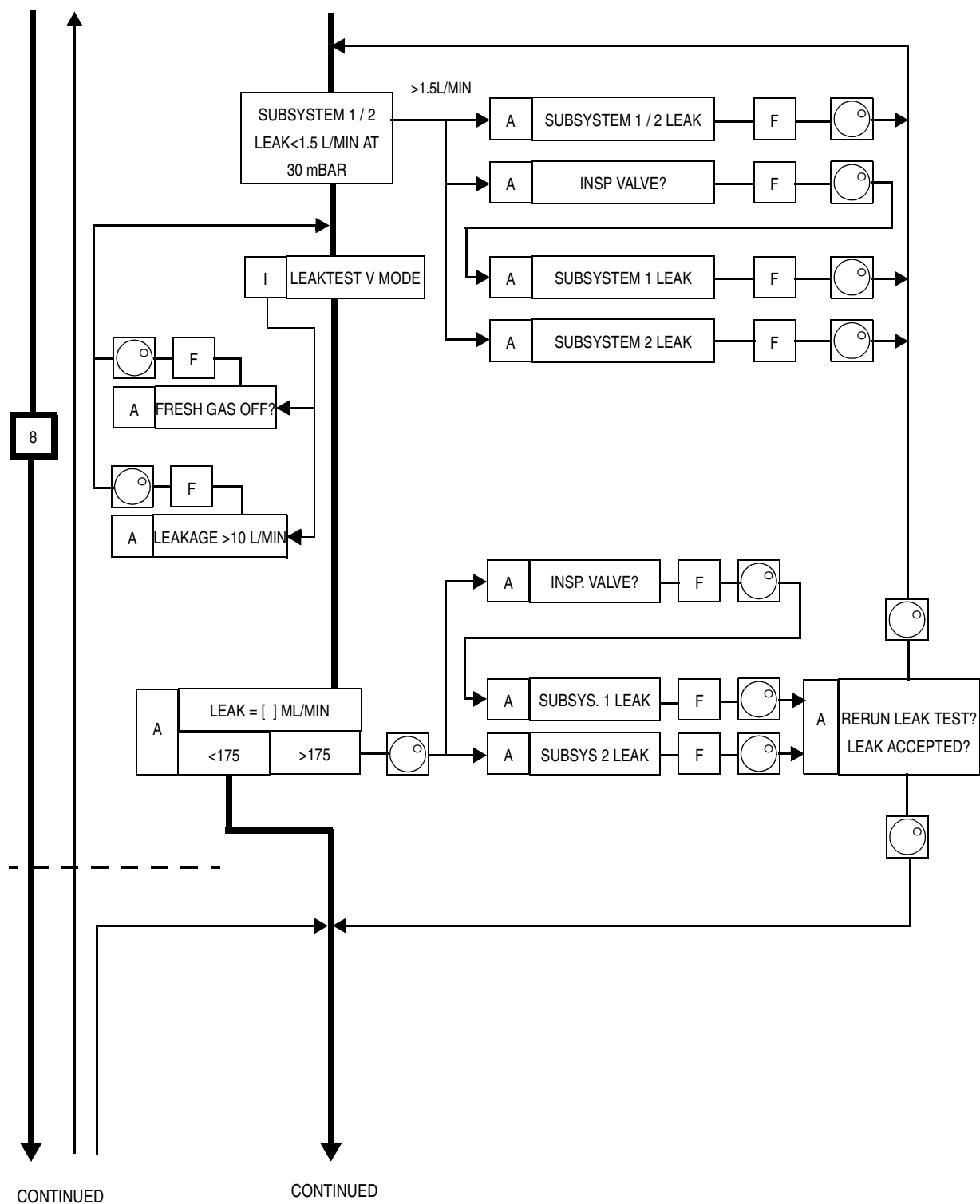
This section contains a flow chart for the Narkomed 6400 Divan ventilator self-test.

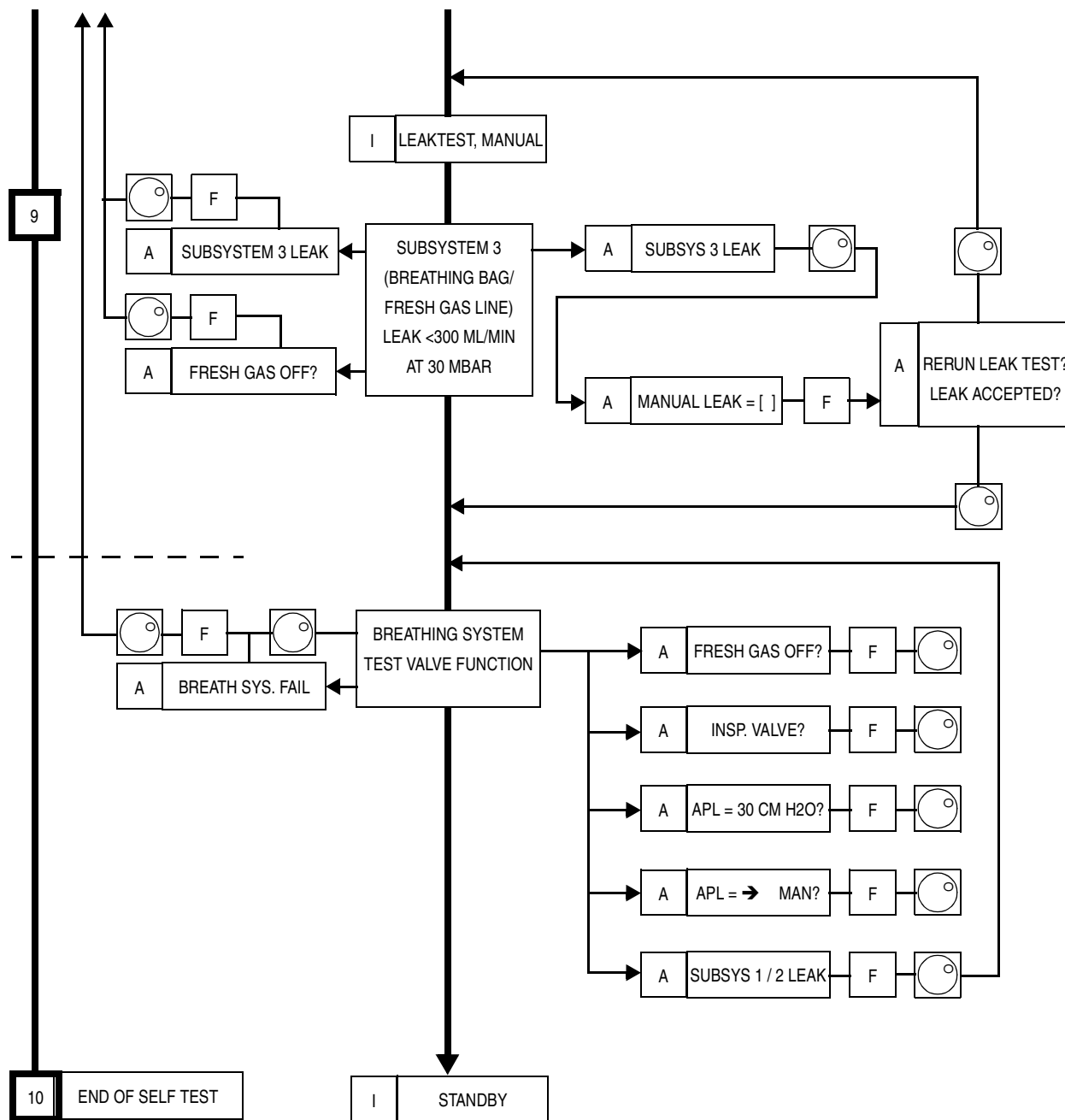
A-4 Divan Ventilator Self-Test Flow Chart





A-4 Divan Ventilator Self-Test Flow Chart





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